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HEALTH SERVICES

INFORMATION SERVICES OPPORTUNITIES & TRENDS

1993-1998

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(MAP)

Health Services

Information Services Opportunities and Trends, 1993-1998

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Introduction

A
Purpose, Methodology, and Organization

1. Purpose

There are five basic objectives in this Market Analysis Program vertical market report:

- Introduce the reader to the medical and health services industry's structure and demographics
- Identify the business issues and trends that are driving the use of information services within the medical industry
- Discuss the manner in which the medical industry uses information systems and the issues facing medical industry information systems organizations
- Discuss the information services market within the medical industry, including market sizing and the factors driving market demand for each delivery mode
- Discuss the competitive environment and profile-leading information services vendors in the medical industry

2. Methodology

Much of the data on which this report is based were gathered during 1993 as part of INPUT's ongoing market analysis programs. Trends, market size, and growth rates are based primarily upon in-depth interviews with users within the medical industry and the IS vendors serving the medical industry. INPUT maintains ongoing relationships with, and a data base of, all users and vendors that it interviews.

In addition, extensive use was made of INPUT's corporate library located in Mountain View, California. The resources in this library include several on-line periodical data bases, subscriptions to over 50 computer and general business periodicals, continually updated files on over 2,500 information services vendors, and the most up-to-date U.S. Department of Commerce publications on industry statistics.

It must be noted that vendors may be unwilling to provide detailed revenue breakouts by delivery mode or industry. Also, vendors often use different categories of industries and industry segments, or view their services as falling into different delivery modes from those used by INPUT. Thus, INPUT must estimate revenues by these categories on a best-effort basis. The delivery mode and individual segment forecasts should be viewed as indicators of general patterns and trends rather than as specific, detailed estimates for individual years.

When the information is provided from vendors as requested, at times it is provided under an agreement of confidentiality. Therefore, vendor rankings based on these revenue figures should be considered indicative rather than definitive, and the revenues themselves should be viewed as approximations only.

3. Organization and Contents of Report

After this chapter's analysis of the impacts on the medical industry of general business and social trends, the remainder of this report is organized as follows:

Chapter II—Industry Trends, Events and Issues—provides background information on industry-specific business and social trends that are driving the use of information services within the medical industry. This chapter focuses on medical industry-specific trends and events, including the pressures of medical cost containment, new competitive pressures, and the outlook for major changes in the current system of paying for and managing health care.

Chapter III—Information Systems—provides an overview of the basic business and operational processes in the medical industry and their supporting information systems applications. For example, discussion of how the medical industry uses information systems both to operate and manage its business activities and to support the work of medical professionals is included. Networks and data communications are an important part of this analysis.

The impacts of new and emerging technologies on applications and the IS organization are addressed in the context of user needs and concerns, as are organizational and budgetary considerations.

This chapter identifies specific questions that should be asked and situations that should be addressed in developing a business strategy to provide information services to one or more segments of the medical industry.

Chapter IV—Information Services Market Forecast—looks at the medical industry from two viewpoints:

- By delivery mode—How are these services delivered? INPUT's major categories of delivery modes are:
  - Professional Services
  - Systems Integration
  - Systems Operation
  - Processing Services
  - Network Services
  - Software Products
  - Turnkey Systems
- By industry segment—Who is buying information services? In other words, what segments within the medical industry are buying services in which delivery modes?

Overall market forecasts are provided by delivery mode and industry segment.

Chapter V—Vendor Competition—identifies leading IS vendors in the industry, discusses some of the factors that affect the competitive dynamics of the industry, and profiles representative vendors.

Chapter VI—Conclusions and Recommendations—reviews the trends and opportunities described in the report and provides recommendations for vendors as well as users.

In addition, there are two appendixes:

Appendix A presents any industry-specific definitions used throughout the report.

Appendix B presents the Forecast Data Base and the Forecast Reconciliation. The Forecast Data Base contains a yearly (1993-1998) forecast of user expenditures by delivery mode for the medical industry as a whole and for each industry segment. The Forecast Reconciliation compares this report's forecast with the forecast provided in INPUT's previous medical industry report and explains the reasons for any major differences.

B

General Business and Social Trends

Several national business and social trends impact the medical industry, as listed in Exhibit I-1.

EXHIBIT I-1

Impacts of Business and Social Trends

- Uninsured population rising
- Acute urban problems and needs
- Elderly growth: The "greying" of America
- Rising medical costs, business responses

In the 1992 presidential campaign, Bill Clinton cited repeatedly his commitment to end the financial and personal uncertainty faced by the many Americans without health insurance. As of mid-1993, the "standard" Census Bureau figure for people uninsured at some time during a one-year period is 37 million—16.7% of the non elderly population, up sharply from 32 million in 1988. One private expert puts the number much higher, at 57 million uncovered at some time during the year, with tens of millions of others "under-insured"—without adequate coverage to meet their medical needs. The American Hospital Association estimates a $10 billion annual, unreimbursed cost to care for the uninsured nationally.

Social and business trends leading to growing ranks of the uninsured and under-insured include: corporate restructurings and layoffs, a shift from union-organized production work to lower-paid and lower-benefit service jobs, and employment by small firms that do not provide medical insurance. Also, some are excluded after testing positive for the AIDS virus HIV, or for other pre-existing medical conditions.

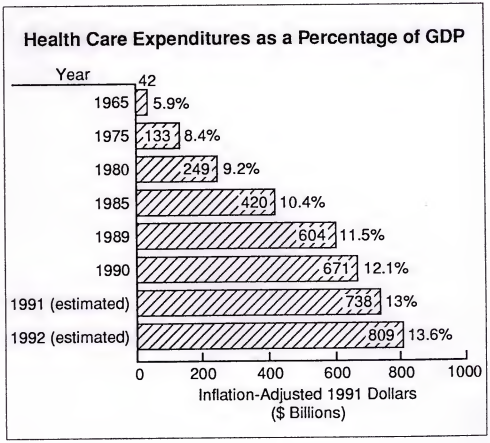
A wide range of urban problems and needs acutely impact the medical industry. Poverty from unemployment and low-wage jobs can impact health negatively and lead to crime-related injuries. Urban poverty often correlates with lack of medical insurance, as well as high concentrations of AIDS infection and drug abuse that strain urban medical systems; reports of new AIDS cases are growing at 75% annually.

Due to the "age wave" or the "greying" of America's "baby boomers," there will be constant pressure on health expenses as the nation's elderly population rises from 13% of all citizens to an estimated 19% in 2030—66 million Americans over age 65, versus 26 million in 1980. As life expectancy rises from today's average—age 75—up to 85 or higher in the future,

nursing homes will serve an estimated 6 million elderly by 2040, versus 1.7 million in nursing homes today.

Statistics on America's rising health care costs come in several forms. The U.S. government Health Care Finance Administration cites an 11% annual rate of increase, especially due to costs for the increasing use of sophisticated and expensive medical technologies such as CAT scan and Magnetic Resonance Imaging (MRI) machines. From 1979 to 1990, national health expenditures have risen 207%, while the Gross Domestic Product has gone up just 122% in the same period. For 1993, the estimated total of U.S. health care services spending will be over $900 billion, up from $250 billion in 1980. Looked at another way by the federal Health Care Financing Administration and the Department of Commerce—as shown in Exhibit I-2—from 1965 to 1992 national health care spending has risen from under 6% of the Gross Domestic Product to nearly 14%. In the 1980-1992 period, federal government health care spending has risen from 12% of the federal budget to 17%; projections are that federal Medicare and Medicaid spending could exceed $400 billion by 1998—up from about $220 billion in 1991—if there are not changes in the existing system.

EXHIBIT I-2



As the main payers of medical insurance premiums—spending an estimated $140 billion per year on health care—U.S. business have responded to rising health care costs in several ways. The most visible response is the rise of "managed care" health insurance plans, where employees receive higher benefit levels when they accept treatment at a designated, fixed cost Health Maintenance Organization (HMO), or agree to be treated by Preferred Provider Organization (PPO) hospitals, clinics, and physicians that have contracted to charge the plan at lower rates and to consult with the plan for preapproval at certain stages of treatment. In addition, employers today demand increased documentation of medical claims to try to contain costs. Finally, many firms have accepted—if reluctantly—the need for federal government involvement in health care reform (see section II.B.5. of this report on federal health care reform).

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CC:

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Dear Colleague,

Enclosed is your copy of INPUT's 1993 report on the Health Services Industry Market. This edition, covering the 1993-1998 period, continues our new approach to major vertical markets, in that it combines the traditional INPUT interview-based survey and forecast activity, with the vision of an industry expert. INPUT believes that this combined approach strengthens our assessment of the trends, issues, technology and market developments that currently drive this market.

For this report, INPUT interviewed a broad range of users and Managers of Information Systems, plus a number of leading vendors of information services to the industry. This survey base, coupled with the knowledge of an experienced industry specialist, has resulted in what we feel is a highly informative and insightful report.

I would be pleased to receive your opinions and suggestions on this or any other of our reports in this new format.

Sincerely,

Bob Goodwin

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Many vendors leverage INPUT's proprietary data and industry knowledge by contracting for custom consulting projects to address questions about their specific market strategies, new product/service ideas, customer satisfaction levels, competitive positions and merger/acquisition options.

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September 1993

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For this report, INPUT interviewed a broad range of users and managers of information systems, plus a number of leading vendors of information services to the industry. This survey base, coupled with the knowledge of an experienced industry specialist, has resulted in what we feel is a highly informative and insightful report.

Please insert this report behind the *Health Services* tab in your Market Analysis Program binder.

I would be pleased to receive your opinions and suggestions on this or any other of our reports in this new format.

Sincerely,

Bob

Robert L. Goodwin
Manager
Information Services Market Analysis Program

Enc.

II

Industry Trends, Events, and Issues

This chapter discusses trends, events, and related issues in the medical industry in the context of the industry's structure. Special emphasis is placed on factors that should be addressed by IS vendors in developing a business strategy.

A

Medical Industry Structure, Segmentation, and Finances

Of the more than $900 billion projected by the U.S. Commerce Department for 1993 national health and medical services spending (SIC 80), by far the biggest category is spending for hospital care, at over $360 billion, followed by physician services, at more than $170 billion. Nursing home care—at over $75 billion—ranks third. Although much smaller in total spending—somewhat over $15 billion—the 1992-1993 growth rate of 30% for home health care services is more than double that for most other categories in the sector.

Exhibit II-1 lists the top ten profit-oriented providers of health care services, as of 1992.

EXHIBIT II-1

Health Services

Top Ten Health Care Services Firms, 1992

1. HCA-Hospital Corporation of America
2. National Medical Enterprises
3. Beverly Enterprises
4. Healthtrust
5. American Medical Holdings
6. U.S. Healthcare
7. Foundation Health
8. Hillhaven
9. Manor Care
10. Lifetime

Some 7,000 U.S. hospitals account for almost 40% of national health care expenditures. That number of hospitals is split between about 1,700 that are operated on a for-profit basis and approximately 5,300 nonprofit community hospitals, of which roughly 1,600 are public hospitals.

Physician services are in transition in terms of point of service: The trend is away from individual private practice and toward joint practices in small- or large-group clinic settings that provide mutual backup, case consulting, and shared costs of computing and other administrative services.

Over 15,000 nursing homes are in operation, with 1.7 million beds. Thirty-six percent of these are operated on a for-profit basis, and 45% of all nursing home fees are paid by Medicaid—often after the elderly patient has exhausted personal financial resources.

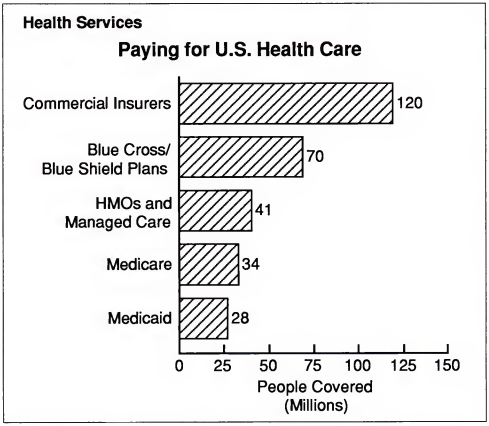
The smaller but fast-growing home health care segment serves about five million Americans at present. Leaders include Olsten Corp. (after their 1993 acquisition of Lifetime Corp.) and Caremark—each in the $900 million to $1 billion revenue range—and others like Abbey Healthcare.

In the hospital sector in general, the trend is toward multihospital systems, with just over 50% of all community hospitals now part of a multihospital system, versus just 30% in 1979. Such systems share services and cooperate in many ways, especially to pool purchasing power and to coordinate purchasing decisions.

Regarding multihospital systems, during 1993 two specific changes have impacted revenue leadership in the sector. HCA-Hospital Corporation of America remains one of the largest chains of hospitals, at $5 billion in revenues, 73 hospitals and 17,000 beds. As of mid-1993, however, two things had changed for other large operators of hospitals. Early in 1993, industry giant Humana split off its hospital operations to Galen Health Care Inc. to focus on its HMO managed care operations. In June 1993, Columbia Hospital Corporation acquired Galen, putting the renamed Columbia Healthcare Corp. up among the leading hospital chains—with combined revenues estimated at about $5 billion for 99 hospitals and 22,000 licensed beds—along with HCA and other big chains like American Medical Holdings and its 35 hospitals.

As shown in Exhibit II-2, several different financial mechanisms pay for most citizens' health care services. Commercial insurers cover about 120 million people, Blue Cross/Blue Shield plans serve approximately 70 million, and Health Maintenance Organizations (HMOs) and other managed care plans are used by around 41 million. Public funding serves 34 million through Medicare and 28 million through Medicaid.

EXHIBIT II-2



As of 1992 there were about 10 million U.S. health care workers, with over 60% of them working in hospitals and nursing homes. Overall, the rate of job growth was 9% annually, and nurses represented the single largest group of jobs: approximately two million.

B
Key Issues

Exhibit II-3 summarizes the key issues facing the medical industry at this time.

EXHIBIT II-3

Health Services

Key Medical Industry Issues

- Medical cost containment
- Services: Oversupply and shortages
- Adapting to managed care pricing and documentation
- Achieving profits—or breaking even
- Federal health care reform

1. Medical Cost Containment

Exhibit II-4 outlines the issues of medical costs that impact the industry.

EXHIBIT II-4

Health Services

Controlling Medical Costs

- Medical cost increases, federal responses
- PPS- and DRG-based federal payments
- Medicare reimbursement patterns
- Managed care initiatives by business
- Hospitals: Inpatient versus outpatient services

As noted earlier, annual medical cost increases of 11% will drive 1993 national health care spending to more than $900 billion. Moreover, President Clinton has made it clear that he believes one factor in the control and reduction of the federal budget deficit is to control health care outlays. Thus, one of his initial budget and deficit-reduction proposals is to cut the projected growth in Medicare spending by more than $50 billion over a five-year period by reducing Medicare reimbursement rates. While this proposal would limit Medicare spending growth to the 10%-11%

range, total spending would still rise from $165 billion in fiscal year 1994 to almost $240 billion in 1998. There remains substantial uncertainty, however, about the actual cuts that will come out of a final House/Senate conference bill during 1993—and in future years. Backing up the perception of a need for cuts in Medicare spending is the projection by the Social Security Administration that—at current rates—the Medicare insurance trust fund will be bankrupt by the year 2000.

Calls for current and near-future cuts in federal health care spending build on changes that began in 1983: the introduction of the PPS (Prospective Payment System) and DRGs (Diagnosis-Related Groups). At that time the U.S. government undertook major changes in federal Medicare payment for hospital in-patient treatment. DRGs were assigned to specific medical conditions and treatments, and the new system—PPS—was established, under which hospitals would be paid at a fixed rate for each DRG.

With PPS and DRGs, suddenly hospitals and physicians with Medicare patients were forced to enter the world of cost-accounting to avoid losses under federal standards, rather than just charging "usual and customary" rates that they could modify on their own. Moreover, the period since 1983 has represented an unrelenting squeeze in Medicare reimbursement patterns, with the federal government revising DRG-based payment schedules yearly. Generally, these revisions have represented reductions in the rates paid for treating specific conditions.

Businesses continue to bear the brunt of health care cost increases, with average employer benefit costs up over 10% in 1992. One factor in rising employer-paid insurance fees is the shifting of health care costs—especially by hospitals—from the uninsured and from shrinking reimbursements for Medicare and Medicaid to charges levied on other patients; this is estimated to add 15% to the cost of businesses' group health insurance plans.

The response of business has been a strong migration toward "managed care," a loosely used term that is understood today as encompassing much more than Health Maintenance Organizations (HMOs) that provide strictly controlled service on a fixed-fee basis to subscribing employers. As a broader concept, managed care can be thought of as any set of limits on enrollees' ability to choose physicians or treatment options on their own; also, managed care generally includes some form of cost controls. While HMO enrollment is substantial—18% of the non elderly population as of 1991—a comparable number of Americans are covered by Preferred Provider Organizations (PPOs) that apply financial incentives to encourage consumers of health care to use doctors and institutions that have negotiated discounted rates with the PPO. Finally, almost all other employer-paid health coverage plans today require some form of precertification (approval before non emergency treatment) or other controls on utilization of medical services that are designed to save money for the business footing the bill.

As one result of federal programs and business initiatives to limit medical cost increases, there is underway now a substantial national shift from inpatient to outpatient services. To take one example, over half of all surgery now is done on an outpatient basis—either by hospitals or at doctors' offices or surgical outpatient clinics. Hospital executives surveyed anticipate that by the year 2000 net outpatient revenues will account for more than half of all hospital patient revenues.

2. Services: Oversupply *and* Shortages

Nationally, the U.S. faces a contradiction between general oversupply and specific shortages, as outlined in Exhibit II-5.

EXHIBIT II-5

Health Services

Variations in the Supply of Medical Services

- National oversupply of hospital beds
- Urban areas: Public hospitals in distress
- Unbalanced specialization of doctors
- The plight of the uninsured

Due in part to a strong cost-containment shift from inpatient to outpatient treatment, hospital admissions in 1990 totaled just 31 million, compared with 36 million in 1980. In parallel, according to the American Hospital Association, since 1985 hospital occupancy rates have hovered at about 65%, meaning that roughly 200,000 hospital beds are empty—representing unreimbursed costs—each night.

The 5,300 community hospitals in the U.S. at the end of 1991 represent a decrease of roughly 10% since 1987, with 322 community hospitals shut down in that period and another 229 mergers. On both the nonprofit and for-profit sides, more mergers and closures are expected if national health care reform is enacted. This is because reform's cost-control pressure on doctors and hospitals will drive hospital consolidations, acquisitions, and other forms of alliances and collaborations—such as sharing of high-tech equipment and certain services. In Boston, for example, five big teaching hospitals associated with Harvard Medical School are consulting on eliminating redundancies, both by reducing excess numbers of beds and by cutting duplicate high-technology programs; observers see these and other Boston-area changes leading to thousands of medical services staff layoffs. On a national basis, such changes generally will be made to cut excess capacity locally and better cover fixed costs, or so that hospital groups can negotiate more strongly for managed care contracts.

Unfortunately, the glut nationally of hospital beds is out of sync with the acute health care needs of urban areas—including needs that derive from urban concentrations of poverty, crime, and drugs—especially given the financial distress of the public hospitals that shoulder much of the burden of care there. In New York City, for example, only 10% of hospital beds are reported to be unoccupied. For many poor and uninsured urban residents, the public hospital's emergency room is their only source of medical care: In 1990 an estimated 43% of the 96 million emergency-room visits were for non urgent medical conditions—at a cost to the hospital that typically exceeds $500 per visit. At the other end of the spectrum, some rural areas have lost enough population that they can no longer support keeping a local hospital open.

Although medical-staffing experts have documented strong needs for more effective primary and diagnostic care in the U.S., the medical training and reimbursement systems remain strongly weighted toward specialization by doctors. Not only are 70% of all U.S. doctors specialists today, the trend continues: The vast majority of new medical school graduates—over 80% in 1992—are specialists, in part because the reimbursement system continues to reward specialists with better incomes. To better meet society's needs in the future, experts see new incentives being established soon—most likely at the federal level—to drive a shift toward more emphasis on primary care.

Occupancy rates and specialization issues, of course, are of little concern to the many Americans uninsured for the cost of medical care (see section I.B. of this report). Whether excluded by AIDS or other pre-existing medical conditions, or employed by an organization providing no health plan, or unemployed or otherwise not covered, the uninsured face both spotty access to routine medical care and financially devastating consequences if hospitalization is required. The plight of the medically uninsured—plus many Americans' anxiety that they could be the next to be laid off and lose medical benefits—is one of the key drivers of federal health care reform (see section II.B.5. of this report).

3. Adapting to Managed Care Pricing and Documentation

Exhibit II-6 summarizes the new financial realities of U.S. society's shift toward managed care.

EXHIBIT II-6

Health Services

Managed Care: The New Financial Realities

- Setting the pattern: Federal DRGs and the PPS
- Business-oriented HMOs and PPOs
- Evolving patterns of managed care
- Documentation issues
- Financial impacts of managed care
- Other impacts

As outlined earlier in this chapter, the federal government's shift during the 1980s toward DRGs and the PPS for Medicare reimbursement fundamentally shifted financial realities, first for hospitals and then for physicians. Building on this base, businesses embraced first HMOs and then PPOs to control their health benefits expenses. HMOs cover 41 million in the U.S. today, up sharply from the 10 million covered as of 1982. PPO-based coverage is becoming increasingly common for businesses, with a corresponding evolution toward managed care even among traditional fee-for-service indemnity insurance plans—in the form of requirements for consultation with the plan before many treatments, or review and justification of practice and costs during treatment.

At the same time that managed care plans increasingly pressure medical professionals and institutions to justify their actions according to treatment-protocol standards—and highly visible malpractice suits and insurance company pressures often drive doctors to practice "defensive medicine," especially in the form of excessive testing—another trend derives from this emphasis on documentation of care. With improved protocol-related documentation, measurement of the relative quality of medical care—measured by medical outcomes—becomes more practical. In some regions, for example, the media has published statistical information about treatment outcomes, thereby pressuring hospitals in particular to place new emphasis on the quality of care provided.

The bottom-line financial impact of managed care on health providers is negative. Gone is the 1980s period of provider-set rates. Rather, hospitals and doctors seeking to be included in PPOs, and other forms of managed care find themselves forced to negotiate discounted rates in exchange for access to pools of patients. In an extension of the trend begun with Medicare DRGs and the PPS, hospitals and doctors must carefully track, control, and predict costs if they are to survive financially in the era of managed care.

One other impact of managed care—when practiced over wide geographic areas by Blue Cross/Blue Shield plans or by large commercial insurers for national account clients—is to seek higher levels of account wide coordination in the processing of claims for such accounts.

Another key impact of managed care—and one likely to accelerate under federal health care reform—is an increase in marketing-oriented activities by both for-profit and nonprofit hospitals as they position themselves to win preferred provider contracts. One important marketing factor will be their technology base for documenting care and billing (see chapter III).

4. Achieving Profits—or Breaking Even

A series of profitability issues derive from the current state of the medical industry, as outlined in Exhibit II-7.

EXHIBIT II-7

Health Services

Medical Industry Profitability Issues

- Competition among payers
- The impact of Medicare and managed care reimbursements
- The status of non profit hospitals
- For-profit hospital chains
- Reimbursement squeezes on doctors and clinics

As outlined earlier, substantial changes have taken place in how medical care is paid for. A relatively isolated world of payments made primarily either by for-profit commercial health insurers or by non profit state Blue Cross/Blue Shield plans has given way to four-way competition among "the Blues," fee-for-service commercial insurers, managed care plans, and self-insurance programs where firms absorb employees' medical costs directly.

Some of the greatest profitability impacts—especially for the hospital sector—derive from federal DRGs and the PPS. This is especially true for the non profit public hospitals that get 52% of their revenues from Medicare and Medicaid. In this atmosphere, patient care *must* be carefully managed by the institution to maintain its financial health. Today, per-patient resource consumption and other costs must be tracked and balanced continually against federal standards or managed care limits, whether for a non profit seeking breakeven or a commercial hospital that needs to earn a profit. Indeed, now there is pressure to predict resource

needs based on diagnosis, before the tracking of actual treatment even begins. One limitation to doing so effectively, however, is that there are relatively few links yet between most hospital systems for finances and those (if any, at a particular hospital) for clinical care (see chapter III).

Hospitals—both profit and non profit—tend to achieve average margins of revenues over costs of just 4.9% to 4.4% today, down from the 6% range that was typical in 1985. One factor here is rising hospital administrative costs: A recent study of 70 Pennsylvania hospitals found average 1983 to 1990 administrative cost increases of 90%—double the hospitals' average overall increase in spending. At these hospitals, administrative spending rose to 13.9% of budgets in 1990, versus 10.6% in 1993—especially due to increases in paperwork costs for quality assurance, utilization review, legal affairs, and government affairs.

In addition to administrative and other cost increases and squeezes on reimbursements from public and private payers, margins are also impacted by a trend of declining inpatient admissions, which were down 1.1% in 1991 alone—on top of a 13.7% decline from 1980 to 1990—versus hospitals' high, largely fixed capital costs.

For years, the financial health of non profit public hospitals has suffered from the burden of treating poor patients who could not pay for the treatment. They are now receiving some relief from the federal Medicaid Disproportionate-Share Payment Program, which in fiscal 1993 provided an estimated $16 billion in subsidies to compensate for such treatments. Nonetheless, it is estimated that public hospitals as a whole need some $15 billion in capital investments to rebuild neglected capital facilities sufficiently to meet current accreditation standards. Federal health care reform should help—at least on the non capital side—to the extent it guarantees payments and represents a commitment to universal health care coverage (see section II.B.5).

As noted earlier, for-profit hospitals are shifting from the 1980s model of fast-rising charges paid by private insurers to an environment of managed care and fixed reimbursements. As one example, today they typically negotiate discounts in the 30% to 40% range. Clearly the emphasis now among for-profit hospitals must be on cost cutting and cost control to maintain profitability.

Under managed care, pre set reimbursements to doctors—paid directly or through their group clinics—can be as much as 25% below their standard fee-for-service rates, representing a significant squeeze on clinic profits, and to physician incomes that average over $190,000 annually. One response is a drive among some doctors to organize themselves for a form of collective bargaining to limit reimbursement-rate cuts in their negotiations with managed care plans. However, concerns about a union-like image, the implications of "doctors' strikes," and the need for exemptions from federal antitrust laws to make this legal may block this drive.

5. Federal Health Care Reform

Exhibit II-8 outlines the top issues, the uncertainties, and the likely outcomes of today's high-profile push toward federal health care reform.

EXHIBIT II-8

Health Services

Federal-level Reform: Issues and Likely Outcomes

- President Clinton's commitment
- The core issues of reform
- June 1993 outlook
- Trial balloons and alternatives
- Uncertainties

Bill Clinton's strong 1992 election-campaign commitment to federal health care reform made reference both to the hardship impacts on the individual under the current system and to the larger impacts of health-cost increases on the year-to-year federal budget deficit and the mounting national debt. At the national level, another perspective is provided by figures from the Organization for Economic Cooperation and Development, which estimates that the U.S. spends about $2,500 annually per capita on health care, compared with just $1,500 in Europe and only $1,200 in Japan. An alternate perspective on the 14% of GDP that we spend on health care, however, comes from observers who regard this high percentage of national income spent on citizens' health as a natural correlate of a high standard of living.

The drive for national health care reform derives from all the factors outlined in this chapter, coming together in issues such as: How can broad access to health care be provided while respecting American traditions of freedom of choice? How can a high quality level for care be assured, while remaining in balance with limited resources and equitable distribution of services? How can a reformed system remain accountable to the individual yet also take into account society's needs? What changes in the structure of health care payments are needed, and how will the issues of fairness be handled?

As of June 1993, the outline of Bill and Hillary Rodham Clinton's proposed health care reform package is clear, although various trial balloons continue to float up and many uncertainties remain. Basically, the package will propose that the U.S. be the first nation to implement so-called "managed competition," extending the current managed care model of negotiated, reduced reimbursement rates to a national system of regional

medical care, buying groups—sometimes referred to as "regional health care alliances." Further, the plan guarantees universal coverage for citizens' health care despite economic status or the presence of costly-to-treat pre-existing conditions—including life-threatening illnesses like AIDS. There will be proposals to broaden patients' choice of doctors beyond that typical in today's managed care plans and to reform medical malpractice law. Although there are significant differences, the closest current model to the likely plan—in terms of coverage levels and costs to the individual—appears to be today's coverage for federal workers under their Blue Cross/Blue Shield program.

As one example of the cross-currents that this sweepingly comprehensive proposal generates, the American Medical Association—a potent political lobbying force in Washington—is on record as supporting universal medical insurance coverage, although they also resist some of the proposals that could limit doctors' incomes.

Not under consideration for the U.S. is a "Canadian model" system, under which the government is the sole payer of medical bills, although some argue that the administrative savings of such a plan could pay for it—at the expense, however, of revenues now earned by the multi billion dollar health insurance industry.

Before public release of President Clinton's actual proposals, many trial balloon alternatives for aspects of federal health care were put up and shot down. On the issue of malpractice reform, for example—estimated to have medical-industry savings impacts of as little as $7 billion and as much as $70 billion, depending on the perspective of the observer—one proposal dropped was to shift malpractice liability from individual doctors to the new managed competition plan that they will practice through. On the other hand, the counter proposal to simply cap such legal claims is strongly opposed by the lobby for trial lawyers.

Short-term—at least until Congress acts on the Clinton administration's proposal and the President signs a finalized health reform bill (which he hopes to do by December 1993)—many uncertainties remain. How will the "standard coverage" for all citizens under reform compare with typical Blue Cross/Blue Shield versus private health care coverages? How will employers' current health insurance plans relate to—or be replaced by—the new system, and to what extent will employers and individuals be able to opt out of the new system or supplement nationally mandated coverages? Will today's Medicare or Medicaid programs be rolled into the new system, and if so, when? Will there be a national "ceiling" placed on health care spending? What forms of price controls or other limits will be placed on doctors' incomes and autonomy? What will be done to ease the burden on doctors—and patients—of insurers' second-guessing (often at the end of a telephone line) of the on-site medical professional's treatment plan? With costs to the federal government estimated variously at $30 to $90 billion annually—or $500 billion under alternate scenarios—will the

plan be financed in part with some form of employer payroll tax or "payroll-based premium" (most likely replacing current health plan premiums), and will there be subsidies or other burden-easing provisions for small businesses that provide little or no health coverage now? What about subsidies to buy coverage for the poor, for the unemployed, and for those employed only part-time? What level of copayments will individuals need to make? Will there be a tax on for-profit hospitals, especially if they earn a windfall of new revenues from the new coverages? When and how will the plan be implemented: Phased in by the year 1996 or 2000? Through pilot experiments? Longer phase-ins for prescriptions (if they are covered) and coverage of long-term care (if it is included)? What about new initiatives for preventative medicine or primary care?

These questions reflect today's turmoil in the medical industry, and the corresponding uncertainties are delaying implementation—in the short term—of some of the information technologies detailed in the next chapter. However, 75% of those polled at a March 1993 conference of health industry information systems professionals believe that federal health care reform, once enacted, will accelerate institutions' spending for information systems and services.

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III

Information Systems Environment

Based largely on primary research and interviews with selected medical institutions, plus secondary research using other industry sources, this chapter first outlines how the medical industry organizes and uses information systems, then details major trends in the industry's use of information systems, looks at its key applications, and analyzes the use of outside products and services by health care providers.

A
Organization and Use of Technology

1. Budgets

Exhibit III-1 presents general patterns found in INPUT interviews and surveys and from secondary sources about information systems budgets in the medical industry.

EXHIBIT III-1

Health Services

Medical Information Systems Budgets

- More centralization of budgets
- Systems budgets range from 1% to 3%
- Average budget increases of 8.6%

Increasing Centralization - Especially among hospitals (where decentralized turnkey information systems purchases were the pattern in the past), today there is a trend toward more centralized control of systems budgets and spending. This is driven both by the necessity to manage information more carefully to meet payers' managed care accountability requirements and by strategic thrusts toward systems integration— especially of departmentally purchased systems, in a drive toward improved service throughout the hospital.

Budget Range - Medical industry information systems budgets (including hardware, salaries, and all other products and services) range widely from 1% or less to 3% or more of all expenses, based both on the segment of the medical industry and the particular situation of each institution. Nursing homes and similar residence institutions, for example, generally have the least complex and costly requirements; they are estimated to average just 1%. Group clinics of professionals (and, to a lesser extent, individual physicians' offices) are spending relatively more, both for early computerization (or for upgrades from turnkey minicomputer systems to networked PC/workstation/file server systems) and to integrate with one or more local hospital systems; their average is estimated at 2%. Hospitals' needs are the most complex, but even their information systems spending varies widely, depending on budget constraints, the state of their systems, and significant variables such as transitions from processing service to in-house operations or from mainframe (or minicomputer) processing to networked systems; observers of hospital systems generally agree that 3% is at the high end of what most hospitals spend on information systems.

Average Budget Increases - An average annual information systems budget increase of 8.6% was reported in a survey of more than 500 professionals at the 1992 Healthcare Information Management and Systems Society annual conference. Other findings from the survey:

- 37% report that current budgets are up despite economic pressures, especially to meet long-term goals such as boosting productivity and improving the management and administration of the institution.

- 22% cite a stable systems budget; 23% report cuts.

- 27% report that some form of budgeted spending for system operations by outside contractors is either implemented already, has been agreed to, or is under consideration.

- The biggest investment categories for the next two years will be:
  - Patient care and bedside systems
  - Medical records
  - Outpatient services and connections to physicians' offices
  - Bottom line: 75% attribute at least some—or significant levels of—improvement in the financial health of the hospital to information systems

A key projection emerged from this survey, as well: 70% said that information systems budgets should rise either somewhat or substantially in the next two years, especially to meet hospitals' long-term goals.

Analysis of current and projected medical information systems budgets attributes much of 1991 and 1992 spending increases to leading-edge responses to the industry's transition toward managed care, given that such spending comes in the face of extraordinarily tight institutionwide

budget constraints. While certain institutions are continuing such spending increases in 1993—especially to boost productivity and/or financial health —vendors report a "wait-and-see" attitude by many buyers who are uncertain about the shape and impact of federal health care reform. This is reflected in the 37% of those surveyed who report budgets up now, versus 70% anticipating increases in the next two years.

1993 should be a weak year for growth in medical information systems budgets, but 1994 should see a resolution to regulatory uncertainty—whatever the final shape of reform—and both a release of pent-up systems demand and new investments to meet the new realities of the initial implementation of managed competition. Most observers, for example, expect the Clinton administration reform package to include strong recommendations for—if not funding to implement—information systems-based advances in health care, especially to control costs. To take one example of the resulting challenge to a hospital's budget, a comprehensive system for patient care and medical records represents an investment by the institution in a range estimated at $2 to $6 million. To take another example, the estimated cost range for networking a local community of care providers is $5 to $15 million.

Drawing on several sources, Exhibit III-2 summarizes INPUT estimates on how hospitals, on average, have allocated their information systems budgets. Variations among individual institutions, of course, are substantial—for example, between individual hospitals and chains, or between hospitals that still use older processing services versus those that operate systems in-house.

EXHIBIT III-2

Health Services

Hospital Information Systems Budgets

Category	Percent
Salaries	40
Hardware	26
Software (Purchased)	21
Applications	18
Systems	3
Communications	6
External Information Services	4
Processing Services	3
Consulting Services	1
Other	3

2. Hot Technologies

Many hot new technologies, listed in Exhibit III-3, are affecting the way the medical industry designs and implements information systems.

EXHIBIT III-3

Health Services

Hot Technologies for Medical Services

- Patient-care/medical records information systems
- Smart cards
- LAN-based/optical fiber medical community networking
- Non-LAN medical community networking
- "Open systems" networking
- Client/server networked workstations
- Image storage and access
- Physician information systems
- Touch-screen technology
- Tablet/pen-based/radio-connected portable systems
- Expert systems
- Voice recognition
- Executive information systems
- RDBMSs
- EDI

Patient-Care/Medical Records Information Systems - There is a broad spectrum of medical service needs served by new information systems designed to electronically support patient care and medical records. Pioneering implementations report achieving as much as 70% of a patient's medical-care record in electronic form and even the entry of 100% of physician orders electronically (although not necessarily with input directly by the physicians themselves). With studies consistently reporting that 25%-40% of caregiver time in hospitals is spent on charting, quantitative benefits of such systems include efficiencies that lead to reduced nurse staffing levels and overtime, plus cuts in hospitals' fast-rising administrative record-keeping costs. One eight-bed intensive care unit, for

example, recently reported one-year payroll savings of $73,000 from such a system. To take another example, the vendor EDS (Electronic Data Systems) and the HMO Harvard Community Health Plan together have pioneered a comprehensive, all-electronic patient record system that links systems in all departments. They report that this integrated clinical information system cuts by 50% the amount of time that doctors spend in administration. So substantial is the potential impact of such systems that a 1992 Arthur D. Little consulting study estimates that broadly introducing patient care and management systems could save the U.S. *$30 billion* annually in health care costs.

Qualitatively, there are improvements in the usability of information charted electronically (both for real-time patient care and for statistically documenting care and outcomes). Also, there are mixed quantitative/qualitative benefits in the form of faster and more complete access to patient records at precisely the time and location required—for example, to examine a patient's reaction to past drug treatments at the time of prescribing a new drug or in the midst of a treatment emergency.

A wide range of vendors now offers varying implementations of such systems on minicomputer and PC platforms, often under UNIX to ease networking and systems integration. Despite the offering of many systems, critics complain that virtually none are comprehensive or fully integrated—they solve only a part of the patient-care problem. In terms of actual implementations, the survey of over 500 health care professionals (cited in section III.A.1. of this report) shows just 17% of hospitals with any form of bedside computers installed today—and those systems are concentrated in critical care and surgery units; however, nearly double that number, 32%, are evaluating bedside systems now.

Smart cards - One "sleeper" technology that is closely related to patient-care information systems may emerge into strong use under managed competition: The so-called smart card is a credit-card sized device that stores updatable electronic data on an embedded computer chip. Once institution-specific patient-care systems are standard in caring for the individual while inside the facility, the patient's smart card could be loaded at discharge with the relevant records from that treatment. Then the next smart-card-equipped doctor, clinic, or hospital (most likely a member of the patient's same managed care network) to treat that patient could use the smart card to instantly access the individual's medical record. Most likely that institution would transfer data into its own patient-care system, thus achieving extraordinary efficiencies in admitting and record-keeping, as well as improving the quality of care. One inhibitor to smart card implementation in the U.S., however, is a recommendation against its use by WEDI—the public/private Workgroup on EDI (see the EDI section below)—which favors instead communication system-based transfer of medical data.

Networking Technologies - The networking requirements for medical industry information systems are both complex—and thus problematical—and yet critical to the future of medical systems. LAN-based (local-area) networking within the medical facility—hospital or clinic—is becoming standard in the 1990s. There is even the opportunity, for institutions that have not implemented such networking to date, to use new fiber-optic LAN technologies from the start, taking advantage of fiber's great advantages of compactness and capacity, especially for new high bandwidth applications such as image transfer and downloading to workstations of extensive medical records or reference information. Coaxial cable-based LAN bandwidth that is adequate for the office simply will not support medical-image transfer requirements.

Hospitals' desire to closely tie physicians to them for marketing and patient reference purposes and the physicians' evolution to a new working style of flexible information access will drive the networking of the local medical community beyond the walls of a hospital or clinic and its LAN. To date, one 1992 survey reports just 14% of group medical practices are linked to hospitals, at a typical cost of $190,000 per year for a 300-bed hospital. Telecommunications vendors such as GTE and the regional telephone companies stand ready—now that the regionals have been freed from many FCC restraints—to help expand such community networking. In 1993, for example, U.S.West Communications announced plans to build a broadband interactive network for voice, video, and data to serve 14 states—including, of course, local medical communities within those states.

Taking this concept one step further, telephone links can enable remote monitoring by doctors or nurses of patients convalescing in lower-cost home health care situations. Such links also provide access to relevant systems from any field location—for example, doctors' homes or even their cars over cellular links. One pioneering institution claims that physician access is available from over 1,000 locations. To take another example, such networked "telemedicine" offers the opportunity for rural, non specialized hospitals to consult on non routine cases with remote regional or big-city hospitals—and perhaps thereby improve their occupancy rate and bottom line by treating at least some such patients locally, instead of automatically referring them out.

Both LAN-based and wider networking increasingly are taking an "open systems" approach based on medical industry networking standards like HL7 and IEEE MEDIX. Such open networking technologies—which often are based on UNIX and its built-in networking functionality—are expected to dominate medical systems networking of existing departmental systems and new systems; in one survey, 75% of respondents report they are moving toward open systems, although the vast majority say they are doing so only gradually. One advantage of open systems is that they let the institution take a phased approach to information systems implementation, proceeding one step at a time and yet allowing newer systems

to work easily with old ones. A late-1992 survey of readers of *Computers in Healthcare* magazine found that 61% of those responding identified open systems as their primary strategy for health care information systems—and only 17% had a single-vendor approach. Correspondingly, 83% expect all or part of future departmental systems to be UNIX-based.

Client-Server Networked Workstations - Whether or not they are under an open systems umbrella or operate under UNIX, today it is easy to spot powerful minicomputers and workstations in patient-care networks. PC-power evolution, in fact, appears poised on the edge of achieving mainframe-level power. Even with more standard personal computer-level functionality at the bedside clinical care workstation, however, client/server systems can easily make the capabilities of one or more powerful workstations available if required, providing "virtual mainframe-power workstation functions" through the less-expensive bedside system.

However, more prevalent today is implementation of networked client/server functionality that simply divides tasks as required among processors and delivers the results where needed. Client/server architecture is also the key to delivering the kinds of highly graphical, keyboard-independent applications favored by many doctors. Whatever the specific architecture and workstation technology, client/server networking of hospital wide systems means, for example, that a nurse can both monitor vital signs communicated automatically from multiple rooms and access pharmacy or other records as required—and even communicate relevant records out to a doctor's office for remote consultation.

Images - Another key issue in the design and implementation of patient-care and medical records information systems is the extent to which they will support bedside access to images such as digital-form radiology X-rays or CAT scans, waveform records of vital signs, and scanned-in images of records or other documents not entered directly into the system. Though, for example, radiology technologies that record, store, and display images digitally (generally with a film output option as well) are becoming more common, it is unclear how soon the implementation of networking and bedside image displays will be commonplace. One issue is the high bandwidth required, perhaps achievable only with fiber-optic-based LANs. The benefit for efficiency and the potential for improved effectiveness (both at the bedside and through image access by remote experts for consultative purposes) are obvious, and most observers rate image storage and access systems as very important. This is especially true when images can be flexibly integrated with text and data in so-called "multimedia" systems. Other information technologies closely related to the implementation of advanced imaging systems include: automatic indexing, computer output to laser disk, full text retrieval, and workgroup imaging.

Physician Information Systems - Although many physicians as well as nurses and other care-giving professionals will likely make complete use of the new generation of patient-care systems, there should also emerge logical subsets and extensions of such systems that are specific to the special information systems needs of certain physicians, nurses, or medical technicians. For example, some physicians will (at least initially) express a preference to access such systems very simply, and only for information retrieval—and not, for instance, entry of treatment plans. Also, some may wish access not only to patient-specific information, but also to electronically accessible reference information otherwise contained in handbooks (as in the case of medications) and journals (for recent research and treatment reports), as well as to hospital-specific analyses and guidelines about cost-efficient and effective treatment options and protocols.

Touch-Screen Technology - One point of resistance to patient-care systems—especially among older doctors—reportedly is the use of a keyboard. Touch-screen (or mouse pointer-based, for non clinical settings) interaction options to the keyboard will be important comfort factors for many nontyping, computer-illiterate physicians, as well as being useful or necessary in clinical settings without a desktop or where typing or any keyboard access would be too slow or awkward. Building on the use of touch screens for data access, creative developers of touch-screen software should be able to adapt even many input tasks to selection among touch-screen-based options, perhaps in part through "intelligent" presentation of options, based on embedded expert system functionality (see below).

Tablet/Pen-Based/Radio-Connected Portable Systems - Developing very quickly now are a whole new generation of "tablet" pen-based (or, again, touch-screen) portable computer systems the size of a book. While some of these have been designed for medical applications where they plug into a bedside networked computer system, the most useful such systems will prove to be wireless, radio-signal-connected systems. In the 1992 survey of more than 500 health care professionals (see section III.A.1. of this report), a substantial number—13%—of all hospitals report *already* having implemented wireless networks, with another 21% working on them.

In such a wireless system, a local radio-based communication system complements the high-capacity fiber optic LAN in the hospital (although perhaps without the radio bandwidth—at least today!—to transmit images). Using such a system, both physicians and nurses can carry their tablets from room-to-room and through the hallways of a hospital, pausing at any location to enter a request for patient information or an inquiry about treatment costs or protocols, or to enter a diagnosis, a treatment plan, or a prescription. Over the wireless network, their request or input would be communicated to one or more of the hospital's integrated computer systems, with any responses returned in real time—all in total

privacy. Logically, there is no reason such systems could not be cellular- and wire-phone equipped or compatible as well, permitting such access from any location—on the road, from the doctor's office, home, or car, or even from the beach!

Expert Systems - Although experience remains spotty, it appears that expert systems technology is finally breaking into acceptance by medical professionals—especially through patient-care and other physician information systems. Throughout the 1980s, expert systems were prototyped for assistance to physicians in knowledge-based functions such as diagnosis or treatment recommendations, but the professionals targeted at that time generally spurned such systems, presumably because they represented a threat to their professional stature (or perhaps their monopoly on medical authority).

There is now some evidence of a leading edge for such systems in pharmacy systems: Increasingly, doctors are accepting the value of medication-oriented expert systems to provide complete and up-to-date information (sometimes updated monthly on optical disc) on effectiveness, side-effects, and dangerous interactions of multiple medications. With networked systems, of course, it is sufficient to have one such system at a central location such as the hospital pharmacy, assuming it can process multiple inquiries at once on a timely basis.

The next breakthrough likely for medical expert systems derives from the push toward managed care: With treatment protocols becoming the norm under managed care, physicians will be hard-pressed to learn all the details of acceptable protocols. Thus, interaction with an expert-system-assisted patient-care planning system—which perhaps outlines treatment or testing options and requirements given a set of symptoms, a diagnosis, or an initial test result—likely will become more acceptable as a way to navigate these new waters. Similarly, expert system-assisted entry of physicians' orders can be designed in such a way that the order system recommends and thus encourages less-costly treatments before accepting such an order—with, of course, the final decision left to the doctor. To take one example, once multiple hospital systems are networked effectively, a doctor's system-entered order for certain tests could lead a system-embedded expert system to check—on its own—how recently the same or related tests were ordered (perhaps by another doctor) and then offer any such results to the doctor before accepting the test order.

Also, expert systems could be the key to effective information access and display—perhaps from keyboardless, radio-connected tablet systems—through "smart" sets of guided question and answer sequences, especially if presented in the context of what the system has learned through interaction about how that individual tends to look for and use data, or how most people in similar job roles do.

In addition, DRG-based reimbursement puts a premium on accurate planning for and management of the length of a patient's stay; expert systems could prove ideal for helping to judge multiple factors predicted to affect the length of stay, thereby impacting treatment plans so as to minimize this time.

Voice Recognition - Voice recognition technology is already winning important supporters in the medical community. Journals are now documenting (and vendors are actively promoting) a series of medically specialized voice recognition systems that overcome the key limitation of the current state of the art-recognition generally limited only to words and voices "trained into" the system through two to five repetitions of each word for each user's voice. The new systems overcome such limitations by restricting use to designated individuals using limited vocabulary applications with high value. For example, skilled laboratory and radiology technicians can use voice recognition with an accepted and limited set of diagnosis terms to record (for automatic system "typing") their analyses of specimens or images without taking their eyes from the microscope or image display. Reportedly, the accuracy, speed, and lack of fatigue are all benefits, not to mention overcoming missing keyboard skills and avoiding transcription time and errors from handwritten records.

What remain somewhat in the future—as they have for a decade —are broader applicability, untrained speaker- and vocabulary-independent systems. Shorter-term, voice-based access may become an added workstation option to supplement touch-screen and pen-based technologies, given speaker-independent technologies that are already reasonably effective at recognizing a very limited set of commands such as numbers, letters, or simple directional commands.

Executive IS/RDBMs - As noted earlier, patient-care information soon will be recorded and network accessible on a routine basis, including documentation of the outcomes of specific treatments for particular patients/diagnoses, information that is then available for aggregation and reporting. Once supplemented by financial information from systems that are already evolving beyond mere charge capture and billing, hospital administrators will have a wealth of data to access and analyze. Increasingly important to support this analysis will be the use of executive information systems programmed to sift through and report, regularly or on demand, bottom-line impacts, patterns, trends, and points of variance of concern to administrators, especially for the ongoing managed care cost-control mission. Top hospital executives faced with national health care reform and managed competition clearly will need this type of data and such analyses to better manage their resources in an increasingly complex medical services environment.

Executive information systems clearly require relational data base management system (RDBMS) technology for the power required to organize and easily access such volumes of information. What is emerging, however, in the era of managed care billing and documentation and the complex integration of patient-care data, are requirements for RDBMS power for such applications as well—especially as the institution's profit-and-loss business needs drive the integration of these formerly separated functions.

EDI - Finally, a technology now recognized as representing an administrative breakthrough for the medical industry is EDI—electronic data interchange, or direct computer-to-computer communication for routine exchanges of formatted data for specific functions. To take just one example of the potential of EDI, the managed care organization United Healthcare Corp., which serves two million people, reports saving $50 million in 1992 just through the use of EDI.

Already, EDI is in extensive use by medical supplies vendors to speed ordering, delivery, inventory management, and billing of routinely ordered supplies—reducing costs to process a typical hospital's purchase order from $70 to $14, and thus potentially saving such an institution administrative costs of $840,000 annually if used for the year's average 15,000 purchase orders. INPUT estimates that in 1992 over 50% of the dollar value in three categories—medical/surgical supplies, pharmaceuticals, and food or dietary items—were ordered electronically; this should grow to over 60% by 1997. Up-to-date implementations of EDI even can link the hospital's depletion of its inventory of routinely used supplies down to a preset threshold with software triggers for automatic EDI-based ordering of an item, cutting purchasing costs and precluding shortages.

The larger untapped potential for medical industry use of EDI, however, is for electronic claims submission and the payment of reimbursements. One major benefit is faster claims payment, with paper-based hospital claims reportedly taking an average of over 80 days from billing to payment. One EDI service vendor reports that typical paper-based reimbursement times of seven to eight weeks can be cut to two to three weeks using electronic claims. Not only are EDI-based claims received more quickly, but formatting (and therefore error-checking) requirements are said to result in as few as 1% of electronic claims being rejected, versus 33% of paper claims rejected on initial submission (and therefore requiring revision costs and resubmission delays) due to errors. Administratively, total claims preparation costs also can be cheaper (over $3 per paper claim versus under $2 per electronic claim, including EDI costs) and faster with computer assistance, and perhaps future expert-system functions will improve this performance even further.

INPUT estimates that of all the roughly five billion publicly and privately paid health care claims filed in 1992, about 30% were filed electronically. (This proportion is projected to grow to over 50% of the more than 6 billion claims expected in 1997.) Certain classes of the 1992 claims, however, far exceed this average, as in the case of electronic pharmacy claims that approach 80% rates. Inpatient hospital claims by EDI reportedly are increasingly common for Blue Cross/Blue Shield hospital payments—at about 60%—but remain sparse for private payers to hospitals, at 2%. Broadly defining medical claims EDI as the non paper submission of claims either by disc or tape delivery or by direct transmission, INPUT estimates that today about 80% to 90% of all publicly paid Medicare and Medicaid hospital claims, respectively, are filed electronically; physician Medicare and Medicaid claims filed electronically are estimated at almost 50% and about 35% respectively.

Several problems inhibit wider private commercial use of EDI.

First, despite so-called "standards" for paper claims forms, each private payer may actually require somewhat different claims information. This problem is being dealt with by an emerging insurance/medical community consensus around the new ANSI X12 standard for claims.

Second, conditions have changed since early in the 1980s, when an estimated 95% of all commercial medical claims required only summary-level claims forms that were very EDI-compatible. Today, however, tighter claims-review procedures have driven this percentage down to 30% of commercial claims, mainly because payers routinely are requiring supplemental information such as X-rays and physician notes that today cannot be sent electronically via EDI.

To facilitate the transition to medical EDI, WEDI—the Workgroup for EDI, a public/private partnership co-chaired by Joseph Brophy, retired president of The Travelers insurance company—is working toward the administrative simplification of health care. As a first step, WEDI has achieved broad medical- and insurance-industry acceptance of a wide variety of electronic claims submission standards. Brophy estimates that administrative savings in the $10 to $35 billion range are feasible.

In the end, the entrepreneurial spirit may do the most to boost EDI use. For example, one electronic claims vendor, in conjunction with a major insurer in the state of Utah, will pay for the hardware and software required by any Utah hospital, clinic, or physician to submit claims electronically, in exchange for a 3% to 5% service fee on all claims paid. The software provided includes extensive formatting and error-checking, presumably leading to a higher acceptance rate and fewer rejected claims.

As early as 1994 or 1995, depending on final federal Medicare regulations, ANSI X12 for claims may represent a step on the road toward the new, more comprehensive ANSI 837 standard designed to serve all health care transactions, not just claims. This new standard is intended to supercede even the new UB-92 paper/electronic flat file standard for Medicare submissions. ANSI 837 represents a single format—based on more complex variable length data fields—that can electronically accommodate transactions ranging from hospital inpatient/outpatient care, physician office or clinic visits, home health care, dental services, home medical equipment, and long-term care. This comprehensive new formal will also boost EDI use by encouraging electronic communication right within local communities of care givers who provide services in close cooperation under the new managed competition structure.

INPUT believes that electronic commerce (another term for EDI) is a major new information services marketplace and offers an ongoing subscription service that monitors and analyzes this new capability. Of special interest to readers of this document will be INPUT's 1993 report, *Electronic Commerce in U.S. Health Care*.

B

Major Trends in the Use of Information Systems

1. User Needs

The leading user needs to be met by information systems managers in the medical industry are outlined in Exhibit III-4.

EXHIBIT III-4

Health Services

Leading User Needs

- Costs and revenues
  - Adapting to managed care
  - Tracking and containing costs
  - Cutting clinical costs
  - Documenting care
  - Connecting clinical and administrative systems
  - Billing electronically
  - Identifying unprofitable services
  - Marketing services under "managed competition"
- Service needs
  - Boosting professional support
  - Integrating departmental systems
  - Speeding access to records
  - Networking the hospital
  - Networking doctors and hospitals
- Implementation
  - Implementing systems internally versus buying outside services
  - Medical equipment versus information systems

Costs and Revenues - In the decade from 1983 to 1993—which started with implementation of Medicare's cost-controlling PPS and DRGs and now faces the uncertain prospect of the Clinton administration's proposed "managed competition" initiative—hospitals, doctors' clinics, and nursing homes have had no alternative to adapting to the cost and revenue squeezes of the various forms of managed care that have emerged. No matter what specific shape federal health care reform takes once implemented, it is highly likely to extend—and highly unlikely to reverse—the cost-control aspects pioneered during this period by Medicare, HMOs, PPOs, and other forms of managed care, so adaptation to this reality is uppermost in users' minds.

With medical services administrators under constant pressure to track and contain costs in the face of decreased managed care revenues, information systems managers face corresponding pressures to deliver computer functions that assist administrators in tracking costs and containing them.

This is especially true on the clinical-costs side: The need to implement new information systems that serve physicians' and nurses' clinical needs—especially care planning, treatment administration, and record keeping—in ways that boost efficiency and thus cut costs. This need is especially relevant to controlling nursing costs that can vary substantially based on staffing-per-patient ratios and when overtime is required, or can be avoided with help from systems.

On the revenue side, documenting care is a closely related pressure, since Medicare now requires care to be documented in order to be reimbursed, and private payers now review and challenge charges regularly. New systems will play a productive role in meeting this documentation need, especially to the extent that they can bridge the gap that often exists in medical information systems between clinical-support systems and administrative systems—to track treatment in ways that can be translated into both billing and the corresponding documentation.

Similarly, electronic billing (based on EDI—electronic data interchange—sometimes now called "electronic commerce") in the medical services environment has already proven that it can meet the hospital's or physician's need to reduce rejection rates by payers and speed reimbursement. Clearly, both the increased revenue that results and the reductions in administrative costs of claims preparation are important to hospital or clinic business operations in an era of tightly controlled reimbursement systems.

EDI-based cost savings are proving even more important, especially in the pioneering sector of federal Medicare reimbursements. The federal Health Care Financing Administration cites a $110 million saving during 1991 from the 44% of Medicare physicians' claims that were processed electronically. Building on this success, a recently proposed federal regulation would require electronic bills for Medicare to be submitted directly over telephone lines, rather than indirectly through magnetic tape; in some institutions impacted by this regulation, users will need to make very rapid responses to meet this requirement, under the aggressive schedule proposed.

In an era of controlled reimbursements, one key need of hospital administrators in particular is to be able to analyze costs versus revenues for specific services, so as to be able to identify those that are unprofitable and either reform them or drop them, if feasible. Closely related to this need and to the "negative" side of documenting care—the risk of an undocumented charge going unreimbursed—is the positive aspect of service

tracking and documentation. Under the proposed models of managed competition, it is likely that hospitals and physicians will be able to proactively market their services to contracting payers most effectively to the extent that they can show the buying group that they can document and justify alternate discounts under different conditions. In addition, their competitive position may be augmented to the extent they can offer lower-cost electronic billing and service-documentation backup.

Service needs - Medical services professionals—doctors, nurses, and technicians—are still in transition over their willingness to accept information systems that support them professionally. With leading-edge users of such systems increasingly documenting their successes, however, the trend is clearly toward medical professionals acknowledging their need for systems that boost their efficiency and provide information at the point of care, in the process improving professionals' treatment decisions.

The caveat, however, is that speed of acceptance and adoption of such systems mostly likely will be spotty—institution by institution—over the next few years. One uncertainty in the acceptance of clinical systems is the emerging battle over hardware technology for access by doctors and nurses —specifically, nursing-station-based workstations versus bedside/patient-room wall-mounted systems versus highly portable, radio-connected "tablet"/pen-based/touch-screen systems—with the added "wild card" of voice-based access.

One source of critical information for care givers—which can also be important to administrators tracking costs and evaluating service profitability—is the multiple departmental computer systems installed throughout the hospital over the years in laboratory, radiology, pharmacy, and other departments. Unfortunately, such systems have been purchased on a decentralized basis by hospital departments and often operate in incompatible minicomputer-based turnkey environments.

Partially in answer to this networking need, emerging communications standards like HL7 and IEEE MEDIX promise to make networking of departmental and hospitalwide systems feasible, potentially bringing data, text, waveform records, and even radiology images to the bedside point of care—although adapting old systems to the new standards remains problematical. Beyond speeding bedside record access—for example, providing instant access to test results—such systems integration and networking now is being expanded to include doctors' offices and clinics, meeting physicians, needs for computer-based access to up-to-date charts and other records without a trip to the hospital. This also meets the need for flexible consultation among doctors wherever they happen to be at the moment. It can also provide on-line updating of care plans and treatment instructions for nurses and other professionals working directly with the patient. As noted earlier, computerization of such treatment plans and records leads directly to the need for corresponding integration with billing and other documentation systems.

Implementation - In terms of complex information systems implementation, hospitals generally have more experience than clinics and other medical facilities such as nursing homes, which often have found minicomputer- or PC-based turnkey systems or packaged software sufficient for their needs. Such turnkey systems are often sold by the vendor with add-on system integration services, or the hospital or clinic may contract with a third-party consultant or system administrator before or after purchase for system evaluation or setup.

Historically, hospitals have more often purchased information systems and services outside than developed them in-house. At first, given high costs for mainframes, this purchase was often of an outside processing service with functions tailored specifically to the medical industry. More recently, many vendors of software bundled in turnkey systems with lower-cost minicomputers and even networked PCs and workstations increasingly have provided practical hospital information systems. This permits institutions increasingly to meet their information systems needs in-house and migrate away from outside processing services, with the turnkey vendor, the software vendor, or a systems integrator or other consultant helping with implementation. In-house staffing for systems operation is much more the pattern than contracting with outside systems operators.

Not only do hospitals and clinics face everyday revenue-versus-cost squeezes, they also face a conflict in the trade-off choice for capital funds. For example, a hospital's capital investment in information systems must compete with investment in expensive medical technologies that can help a hospital attract leading physicians and their referrals of patients for high-cost treatments. Although this is really an "apples and oranges" question of information systems versus medical technologies, according to hospital executives and boards of directors, such funds are likely to come from a single capital budget. To some extent, however, the financial realities of managed care today—and the new managed competition environment to come—is clarifying this choice for hospitals: While expensive new medical equipment may be desirable, the reality is that documentation and billing-efficiency demands alone most likely will tip the scale toward information systems in the short term—at least once the dust settles and federal health care reform becomes a reality.

2. User Concerns

Exhibit III-5 outlines the top concerns of users about medical information systems.

EXHIBIT III-5

Health Services

User Concerns Regarding New Medical Information Systems

- New systems and their integration
- Professional-level systems: Design and use
- Privacy issues
- Marketing and cost implications of networking

Based on the business issues reviewed in Chapter II, hospital information systems managers in particular face a kind of "shifting ground," technologically. The new world of managed care/managed competition billing and cost-control calls for entirely new subsystems for cost-accounting must either to be incorporated into or grafted onto existing financial and billing systems that emphasized charge-capturing in the past. Integration of such new functions is difficult at best, and in many cases some systems will have to be replaced to bring the functions together effectively. Given financial constraints in the short term, few medical institutions will have the luxury of wholesale replacement of systems. Rather, for most hospital professionals, integration of old and new systems will be a real-world technological challenge for the foreseeable future.

Similarly, the use of information systems to boost professionals' clinical efficiency and effectiveness is just beginning, requiring systems managers to serve users and functions largely untouched in the past. One key concern for patient-care systems, as with most such technology introductions, is the acceptance and use of such systems by professionals, in this case nurses and doctors. Although nurses may be expected to take readily to any technical support that speeds their routine responsibilities, such as charting, physicians may take more of a "show me" attitude. Factors likely to be key to overcoming their concerns and winning their acceptance of new patient-care information systems include faster access to medical records and other information discussed earlier, and consistent demonstration that the technology provides rapid system response times, so they do not feel the system is wasting their time or delaying treatment in a critical situation. Also, physicians may feel more comfortable if they are enabled by wireless, tablet-based systems to interact with the systems out of view of other medical staffers.

One urgent concern is the privacy of the data stored in a patient-care or integrated medical records system. Current paper-based systems require patient consent forms before records are disclosed versus the perception by some that electronic records are easily accessible by those who know computer systems, whether authorized for access or not. This concern is in tension with the requirement for "as-needed" access to both an individual patient's record for treatment decisions and to aggregated data across many patients, perhaps with key personal identifiers removed.

Finally, the increasing need of hospitals for active marketing to win managed care contracts and patient references by physicians underscores a broader concern for those implementing new medical technologies—systems networking can no longer consider only the needs within the hospital's walls to effectively serve the marketing mission. Rather, doctors' offices, clinics, and other professional-care settings must be regarded as parts of a local medical community. This community requires networking integrated with the hospital's systems to provide similar, if not identical, access to the network-based systems from either outside or inside the hospital. In addition to technological and privacy concerns, this raises fiscal concerns about sharing such costs in a era of tight medical budgets.

3. Use of Information Systems as a Competitive Advantage—or Necessity

The 1992 survey of more than 500 health care professionals cited earlier found that 75% reported improvements in their institution's financial health from information systems. Nonetheless, just 30% said they tended to implement leading-edge technologies for competitive advantage, and 20% reported lagging behind such leading-edge implementations.

It appears that two competitive cross-currents are at work here. First, until the recent era of managed care, competition had little impact on medical services: Physicians and hospitals practiced medicine largely outside any market mechanisms—as distinct from the insurers who paid most of the bills. Recently, however, this has changed under federal Medicare and private-sector managed care initiatives, and competitive dynamics are expected to change with a vengeance under federal health care reform that mandates managed competition. Second, with reform driving institutions quickly into the competitive world, new use of information systems will not be just a matter of competitive advantage in a marketplace big enough for all and somewhat forgiving. Rather, institutions' survival may be at stake—especially if effective information systems are one key to winning sufficient managed care contracts to stay solvent. Thus, new systems will become necessities in a newly unforgiving marketplace, all players will drive toward such implementations simultaneously, and little relative advantage will derive in more than the short term.

The good news in this situation is that real operational cost savings and quality improvements may derive from such systems implementations, assuming the capital can be found to invest in them. Often, so-called re-engineering of medical practice can accompany systems change—as opposed to simply computer-equipping today's procedures. In such a scenario, the midrange or long-term result may be a national medical system that ceases hemorrhaging money and delivers better value in health care. The competitive route there, however, likely will prove rocky.

C
Applications

Though some applications used in the medical industry are common to other industries, many of the systems categories listed in Exhibit III-6 are unique to the medical industry.

EXHIBIT III-6

Health Services

Categories of Medical Information Systems

- Billing and financial accounting systems
- Cost and profitability analysis systems
- Patient business information systems
- Clinical records and patient-care systems
- Services and patient/resources scheduling systems
- Departmental systems

Billing and financial accounting systems include the specialized hospital billing systems that represented hospitals' first major use of information systems years ago, as well as utility systems such as general ledger and payroll/personnel. As detailed in section III.A.2. of this report, EDI—electronic data interchange—is the fast-evolving next step in medical industry-billing systems. As the key to a hospital's or clinic's reimbursement, it is scarcely surprising that spending on hardware, software, and services for such systems is estimated at 40% of total medical information systems spending. In a recent INPUT-user survey, those interviewed listed such systems the most often as their near-term priority application.

Cost and profitability analysis systems, in particular, have been implemented since the 1983 Medicare PPS and DRGs were established, representing hospitals' attempts to track costs by patients and by diagnoses/treatments, in order to identify the relative profitability of services offered and populations served. Evolving managed care and managed competition environments, of course, only deepen the importance of developing and refining such systems, sometimes referred to as contract-management software.

Patient business information systems relate primarily to the admission, registration, and discharge functions, including records of financial responsibility for billing purposes. When such systems are not part of a comprehensive billing or administrative system, they need to be closely integrated with it.

Clinical records and patient-care systems are one of the strongest emerging categories, as detailed in section III.A.2. of this report and below, aiming to create an electronic analog to the classic paper records of vital signs, care plans, and treatments delivered.

Services and patient/resources scheduling systems cover logistical planning areas such as materials management, patient/facilities scheduling, equipment use, and appointment scheduling.

Departmental systems have developed in decentralized fashion over the years to handle specialized functions for departments such as laboratories, radiology, pharmacy, pathology, and purchasing.

1. Focus: Patient-Care Systems

In addition to the need to integrate information systems and analyze costs centrally on a patient/diagnosis basis, hospitals now realize that computer power can also be harnessed to assist in patient care as well as handle financial functions. (See also section III.A.2. of this report.) Electromechanical medical devices to record heart and other bodily functions generally now incorporate microelectronics, and, in many cases, the resulting charts can be recorded and examined more efficiently in digitized data form (displayed and recalled from memory onto a screen) than on long paper tapes with pen-plots. It is logically only a small step further to connect multiple electronic sensors (and even electronic controls for intravenous infusion of liquids and medications) to a bedside computer. Whether at the bedside or at the nursing station, computerized patient-care systems can assist doctors and nurses in care planning, plotting of vital signs, recording of drug administration, and other treatments and administrative processes. One sign of the emerging acceptance of such systems is a 1992 doubling of revenues for patient-care applications and hardware vendor CliniCom.

The components of the challenges associated with such systems are noted in Exhibit III-7.

EXHIBIT III-7

Health Services

Opportunities and Challenges in Patient-Care Systems

- Electronic charting
- Systems use by medical professionals
- Flexible electronic records access
- Networking multiple systems
- Mixing data, plots, and images
- Longitudinal electronic medical records

Electronic Charting - Charting the recording of a patient's vital signs, care plan, and treatment records (on papers usually kept at the foot of the hospital bed) has always been a sore point for many nurses and physicians. Illegible writing, lapses in charting, and the time and attention required to write records when other duties call or when fast, crisis-based medical action is taking place, are all problems.

Some see electronic, computer-based charting (also referred to as bedside terminals or bedside information systems) as part of the solution. As mentioned earlier, many sensors today can provide electronic input for a computerized chart. Advanced display systems can permit viewing of several such records in time-synchronized displays from memory (or in real time), potentially aiding in diagnosis or treatment decisions. (Variations of such systems are used in many hospital intensive care units now, but otherwise are not yet common.) Equally important, touch-screen-based display, inquiry, and recording systems that minimize or eliminate keyboard entry—which is often a barrier to information systems use by nontyping or older professionals—are now coming on the market.

In 1989, Medicare started requiring full documentation of physician-provided care, ideal for automatic output from a well-designed electronic charting application. In fact, already the prevailing wisdom in the "DRG era" is, "If it's not charted (on paper or electronically), don't bother to bill for it ... it will be challenged or rejected out of hand by Medicare or the managed care entity."

Systems Use by Medical Professionals - As with many industries, there is a reluctance by professionals (doctors) to accept the use of some types of information systems. Though physicians in clinics readily accept the computer-based accounting and billing performed by administrative staffers, for years they have resisted attempts to apply expert systems software as an aid to the diagnosis or treatment-plan process. Because physicians are used to scribbling on paper charts (and getting away with it, at least until the recent Medicare documentation clampdown), it is unclear what it will take to motivate them to use electronic charting systems. Perhaps if nurses or paraprofessionals can be enlisted to aid physicians in entering patient-care plans initially on the electronic charting system, there will be less resistance to entering treatment data or care plan changes directly, especially with an easy touch-screen interface. Nurses, on the other hand, can be expected to derive major efficiency benefits from such a system and should take quickly to any means that makes their jobs easier, especially the tedious task of end-of-shift documentation.

Flexible Access - Properly networked, bedside charting records could be available electronically at any time from virtually any location. At minimum, a physician should be able to stop at one hospital location and view electronic charts for all his or her patients before deciding which to visit or in which order to make the rounds. At best, physicians could monitor charting from their remote, networked clinic (or private) offices (with networking costs possibly paid by the hospital(s) that want the physicians' referrals of patients or are part of the same managed care network) to determine progress or problems and to change care instructions directly into the bedside system, rather than through a phone call from or to the nursing station. Expert systems could, by accepting instructions to monitor for certain changes in a patient's condition, alert the physician and/or nurse automatically (even automatically paging the physician, if necessary) if circumstances require.

Networking - As discussed earlier, networking is, in one sense, the challenge of connecting multiple, independently developed systems. Patient-care systems will be most effective when they both connect with local sensors and control devices and can accept connections from departmental systems such as those in pharmacy and radiology. Pharmacists, for example, could modify (or at least recommend modification of) medications sent down for the next mealtime based on electronic access to the patient's vital signs and either standard-practice protocols or physician-set standards for status-based dosages or alternative medications. The physician at the bedside or at a remote office could read the radiologist's textual entry of findings while viewing an X-ray or CAT scan in real time, without needing to have the film or analysis physically available, or without having to go to the radiology department.

Mixing Data, Plots, Images - Networking systems and applications already are moving toward the objective of bedside or remote-location access to X-ray, CAT scan, and MRI images (latest and/or historical) as well as character-based or numerical data. The same goes for viewing one or more continuous graphic plots—not just periodic data—from recording devices monitoring patient functions. Mixing waveform, image, and text/data records as standard-form, transportable documents is indeed one of the objectives and promises of the IEEE MEDIX standard.

"Lifetime" Records - Ultimately, such networking and standardization will make possible, for each individual, a "longitudinal (or lifetime) electronic medical record." In theory, for each person, there can be an instantly transmittable or accessible electronic record of health statistics and medical treatments for as far back as records are captured, either in real-time or entered after the fact. While data base and smart card technologies (see section III.A.2. of this report) could handle such a record today, privacy, legal, ethical, and related questions will have to be addressed before such records become a reality.

2. Focus: Shifting Roles for Systems in Finances

With all this attention to patient-care systems, however, it is important not to lose sight of ongoing changes in how information systems are used for hospital finances, as outlined in Exhibit III-8.

EXHIBIT III-8

Health Services

Hospital Financial Information Systems

- Documenting services
- Profitability analysis and marketing planning
- Tracking outcomes; evaluating treatments

Documenting - As discussed earlier, it is no longer an option for hospitals to carefully document medical services provided and the associated patient-/diagnosis-based charges. Given the mid-1990s environment of managed care—high administrative costs in time and personnel for paper-based records and documentation—there will be substantial new opportunities for vendors of systems products and services to meet this need.

Analysis and Planning - Both within and outside the Medicare-treatment arena, hospitals are starting to use the information resulting from such documentation of services for other purposes. Grouping patients by diagnosis, residence location, age, and/or other factors, for example, can help a hospital administrator judge relative profitability of services offered and then direct community-based, managed care, and physician-oriented marketing efforts to win more high-profit patients.

Outcomes - Similarly, such data can be used to track and analyze outcomes (sometimes referred to with the more value-loaded term, "quality-of-care analysis"), providing guidance to professional care-givers as to the most effective treatments (where alternatives exist) and as to their relative cost-efficiency, either where alternatives are known already or where care-givers can exchange ideas about less-costly alternatives. Though this data is required to some extent by Medicare (where it is subject to often distasteful peer review, for possible rejection of charges) and by managed care plans, it is not clear to what extent physicians willingly will accept such feedback over time.

D
Use of Outside Products and Services

For years hospitals have made extensive use of outside vendors—starting with remote processing services and often evolving to the use of turnkey and application software vendors—to meet their information systems needs. There is no reason to believe this need will decrease; on the contrary, managed care, managed competition, and federal health care reform all are driving medical institutions to change at a pace that internal expertise is unlikely to cope with alone, especially in terms of systems development, integration, and implementation—and potentially in terms of outright systems operations.

One "sleeper" issue—and a major opportunity which systems integrators and consultants like Andersen Consulting, with its "Hospital of the Future" program, are targeting—is that many of the new technologies discussed in this chapter will be most effective only in the context of fundamental re-engineering of medical operations to take account of the new opportunities for information capture and use. To take just one example, with networking of patient-care, medical records, and other systems, one can envision a new routine of checking patients' status through a kind of "electronic rounds" conducted from the doctor's office—or radio-connected car or handheld tablet computer—followed by selective visiting of patients. This is in contrast to simple "electronic augmentation" of traditional practice, whereby the doctor would look at an electronic—as opposed to paper—chart while visiting each patient's room in turn on a traditional rounds tour. Such re-engineering, of course, leads to fundamental quality of care issues, such as: Who replaces the personal touch of the doctor?

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Information Services Market

This chapter discusses the markets for information services in the medical sector. Information in this chapter draws on the statistics, trends, and issues presented in Chapters I, II, and III to outline the anticipated future directions of the markets for information services.

One of the key items discussed is the set of trade-offs between prepackaged solutions—such as processing services, applications software, and turnkey systems—and custom solutions that involve consulting or internal systems development and systems integration support.

User expenditure forecasts are provided for the medical sector, both by industry segment and by delivery mode. Assumptions driving the forecasts are presented. Note that these forecasts do not include functional general-purpose information services, such as for human resources or generic planning and analysis. The markets for these types of information services are presented in other "cross-industry" MAP reports, rather than the "vertical" or industry-specific reports.

Section A, Overview, discusses the overall size and growth rate of the medical sector's expenditures for information services.

Section B, Delivery Mode Analysis, breaks out the overall data into INPUT's seven standard delivery modes.

A
Overview

1. Information Services - Driving Forces

As shown in Exhibit IV-1, a number of business, social, and technical driving forces are impacting the medical sector's use of information services in the mid-1990s.

EXHIBIT IV-1

Information Services
Driving Forces

- Cost control and accountability
- Reimbursement dynamics
- Patient-care systems
- Documenting outcomes
- Local and community networking
- Executive information systems
- Systems upgrading and integration
- Experience with outside solutions

Cost Control and Accountability - With the requirement of the Medicare PPS to account for and bill services according to diagnosis —and of private managed care plans for detailed cost accounting—hospitals, in particular, are under continuing pressure to refine their ability to track and control costs. Medical information systems today and tomorrow must provide far more sophisticated financial capabilities than yesterday's charge-capture and billing systems.

Reimbursement - One side effect of Medicare's (and private payers') stricter charge accounting requirements is an ongoing set of cash-flow problems resulting from reimbursement delays and problems. Not only is reimbursement often delayed by payers' reviews of charges for care, but an increasing portion of charges are challenged or rejected. One information services-related approach to solving this problem is to increasingly rely on EDI-based electronic billing. Electronic billing not only transfers information faster, it also can be structured to include computer-based error checking (perhaps incorporating expert systems functionality) that

permits the charging institution to find and correct errors before transmission and thus lower challenge/rejection ratios. Direct electronic payment on the return route, of course, can also help cash flow, although relatively little of this takes place today.

Patient-Care Systems - Beyond finances, a new generation of patient-care systems is being developed and implemented to assist care planning, charting, and treatment record keeping—in many cases right at the patient's bedside. These new information systems promise greater efficiency for the professionals serving the patient and improved effectiveness of treatment.

Documentation of Outcomes - Closely related to patient-care systems, computer-based documentation of treatment outcomes is both easier with such systems and increasingly required for cost accounting and reimbursement functions.

Networking - Both financial and patient-care systems will depend on new systems-networking capabilities. First and foremost, networking must be established within hospital and clinic settings to maximize information accessibility regardless of the user's location. One especially interesting technological option is to use state-of-the-art new capabilities for fiber-optic local-area networking, so as to accommodate high communications bandwidth applications such as image processing and high-volume records transfers that are emerging as critical to future medical information systems. As important, perhaps, in the midrange time period (if not the short term) is to permit flexible networking outside the physical borders of an institution, especially to the community of professionals such as physicians and therapists in their offices. Such professionals could benefit from flexible access to medical records and patient-care systems independent of their physical location at the moment, and hospitals likely would enjoy higher patient-referral rates from well-networked physicians. In addition, such networking likely will become required for local care-giving associations under managed competition.

EIS - Once the types of systems discussed here are further implemented and networked, medical management—especially hospital administrators—increasingly can benefit from a new generation of executive information systems. These systems can be designed to capture, analyze, and flexibly present to management the summary and trend-level information needed to chart changing courses in matters such as response to Medicare DRG charge-schedule revisions or plans for community-based marketing and outreach to profitable patient groups and managed care groups.

Upgrading, Implementation, Outside Solutions - Almost all of the driving forces outlined here will require significant upgrading and integration of existing medical information systems. Information services vendors positioned to help with such systems evolution should benefit in particular from a medical-sector environment that is generally experienced with and receptive to outside solutions, both from earlier reliance on outside processing services and from more recent use of outside turnkey systems, application software packages, and consulting services.

2. Information Services - Inhibiting Factors

In contrast, a number of forces are simultaneously inhibiting insurers' use of information services, as shown in Exhibit IV-2.

EXHIBIT IV-2

Health Services

Information Services
Inhibiting Factors

- Departmental and old central systems
- Networking obstacles
- Limited in-house experience
- Costly, pioneering new technologies
- Unproven benefits
- Professional resistance
- Expense constraints
- Competing capital investments

Departmental Systems - There is also a negative side to the requirement for major information systems upgrades and integration. It will not be easy either to bring separate departmental systems into cooperative, networked integration or to upgrade old centralized—usually financially based—mainframe systems to meet the new financial and clinical needs outlined earlier. Many hospitals' installed departmental systems, for example, are based on proprietary minicomputer architectures and were bought for specific departmental requirements. Even with emerging systems networking standards like HL7 and MEDIX, it will be challenging to link such systems. Replacement with up-to-date, standard-architecture departmental systems clearly raises many financial problems.

Old Centralized Systems - On the mainframe side, many centralized software systems are as much as 10 or 15 years old. As a result, significant system upgrades based on old architectures and languages may be impractical. Again, replacement raises financial problems, as well as inviting major re-examination of system requirements and functions that could prove costly and disruptive to ongoing operations and busy managers.

Networking - Beyond the challenges of local networking (including the logistical challenge of cabling hospitals without overly disrupting patient care), only the earliest pioneering steps have been taken so far in flexible networking for the larger medical community beyond a hospital's walls.

Limited In-House Experience - Similarly, there is a negative aspect to the medical industry's extensive use of outside solutions. In many cases there is only limited in-house experience with information systems. For example, often vendors and consultants have modified software or turnkey applications to meet specific needs and have handled system implementation, mainly leaving the daily operations to the in-house staff. With limited in-house experience, hospital management may be reluctant to make the financial and organizational commitments required to meet necessary integration and upgrading needs.

Unproven Benefits - Management also may look askance at investing in innovative and pioneering new technologies such as image processing and bedside patient-care systems—technologies with relatively limited track records to date. While the projected benefits are attractive and promising, such new technologies may fall victim to the "let's see what happens when others try that" obstacle. This may be especially true when the benefits offered are often "softer" or "qualitative"—and thus not subject to traditional cost-benefit justifications—as well as generally unproven, to date.

Professional Resistance - Although physicians are not strictly managers (in most cases) of hospitals and other medical institutions, they have demonstrated that their professional-level resistance to a new practice or technology can limit (if not block) its acceptance or implementation. The testing and implementation of expert systems to assist in medical diagnosis, for example, has been severely constrained by most physicians' perception of the technology as a threat to their professional stature or authority. Patient-care systems may meet the same type of resistance if physicians do not see at least efficiency-level benefits. Such benefits should, however, quickly prove obvious to nurses in routine functions such as charting and recording medical treatments.

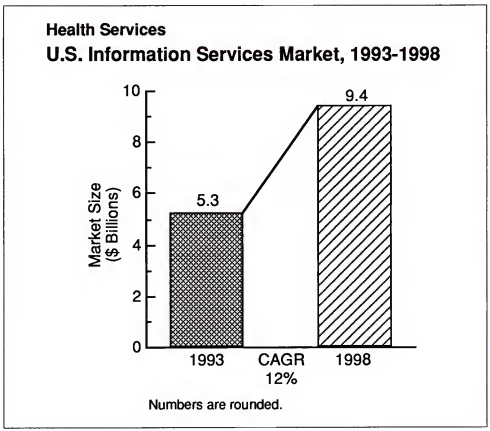
Expense/Capital Investment - Last—and very far from least—in medical service environments where Medicare and managed care payments are a major revenue source, there is simply little extra money in the expense or capital budgets for new information systems initiatives. This is especially

true to the extent that other "medically necessary" costs (such as supplies and nursing salaries) continue to grow faster than the continually tightening reimbursement stream. On the capital side, in particular, there has been substantial competition in the recent past for investment dollars—competition from expensive noninformation-system medical equipment. There are indications, however, that such equipment investments are waning in some instances, and that hospital administrators see the necessity of making sizable information systems investments—now, despite budget squeezes —to boost efficiencies and to keep costs below managed care reimbursement levels. (See section III.A.1. of this report.)

The "wild card" here—as of mid-1993—is the recent past and near future impact of the uncertain final outcome of proposals for federal health care reform. The working assumption in these forecasts is that a number of buyers of medical systems and services are now placing such spending "on hold" where possible, and that such demand will spring back with an initial peak in 1994 and especially 1995, assuming reform is passed by early 1994.

Based on these driving and inhibiting forces and assumptions, INPUT projects the medical sector information services market to grow as shown in Exhibit IV-3.

EXHIBIT IV-3

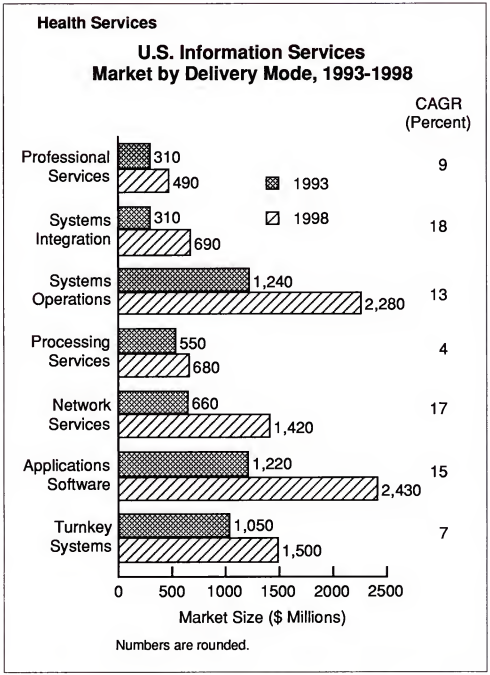


As noted in the assumptions above, during the 1993-1998 time period, overall growth in health services sector information services at first will be restrained, mainly due to continuing reimbursement revenue squeezes and uncertainty about federal health care reform. Growth will increase between 1994 and 1995, both as the reform picture clarifies and as the new technologies on the horizon for medical information services begin to demonstrate their value to a relatively skeptical and cost-conscious audience. In each case, as well, delivery mode-specific factors also play a part, as detailed in the next section.

B
Delivery Mode Analysis

As shown in Exhibit IV-4, there are significant differences projected in five-year growth rates for the information services delivery modes to the health services sector.

EXHIBIT IV-4



For reasons detailed in the individual delivery mode discussions that follow, three modes—applications software, systems integration, and network services—are expected to show especially healthy growth during the forecast period.

1. Processing Services

For many experienced users in the medical industry, the use of processing services on a remote, time-sharing basis—for example, to capture and bill hospital charges—was their first introduction to medical information systems. In recent years, however, the medical sector has joined the general exodus from this method of meeting information services needs, in favor of bringing computing power into the medical institution itself, either in the form of more cost-effective mainframe central processing units or as distributed, minicomputer-based departmental systems.

During the 1993-1998 time period, growth in the use of processing services in the medical sector will decline slightly to 4% (CAGR), responding to the mounting pressure from increasingly powerful internal institutional networks of PCs, workstations, and file servers.

2. Turnkey Systems

Turnkey systems provide an easy-to-implement solution by bundling the required hardware and software into a single package (often including customization and other implementation services from the vendor), but sometimes at the price of providing less flexibility for the user. Historically, most medical turnkey systems have been based on minicomputer hardware platforms and have been most frequently used by smaller institutions with simpler operational needs, such as those operations that cannot afford the overhead of their own internal mainframe-based data processing capabilities and do not need the power of outside mainframe-based processing services. Many turnkey systems sold into the medical industry have been for specialized departmental applications such as laboratory or radiology.

The health services sector turnkey market's growth rate in 1992 stands at a moderate 8%, for two reasons. First, IBM-standard PC platforms increasingly offer minicomputer-level, networked functionality in a lower-margin system based on a standard operating system (generally DOS, Windows, or UNIX), as opposed to minicomputer vendors' often incompatible and proprietary operating systems. More and more medical industry turnkey and application software vendors today write their systems on generic PC platforms scaled to the level of processing power their software requires. They will usually bundle the software with the lower-cost PC hardware or leave it to the buyer to purchase compatible hardware from one or more of the PC hardware vendors.

Second, even in the minicomputer market where turnkey systems vendors grew rapidly in the past, IBM—as a strong medical industry hardware vendor—in recent years has established a new alternative for minicomputer hardware/software sales. Typically, IBM now sponsors software vendors as "business partners" with solutions for IBM equipment sets—

which the partner still may package with their software as turnkey systems. Increasingly, however, IBM also sells (and services) the required equipment directly to the purchaser of the business partner's software, rather than selling the equipment at wholesale to the turnkey partner, for them to resell at a profit. A small commission-like payment is made to the participating business partner when IBM wins such a competition on the equipment side. As a new generation of powerful distributed workstations enters the market, the same nonturnkey approach will likely take hold as well, especially as UNIX-based "open systems" workstation architectures provide a stable platform for software developers.

INPUT forecasts a small growth-rate decline—to 7% CAGR—for medical turnkey systems during the period 1993-1998, with expenditures going from just over $1 billion in 1993 to $1.5 billion in 1998.

3. Application Software Products

As outlined in Exhibit IV-5, medical application software products vendors for several years have enjoyed the benefits of industry conditions that favored their products. Of primary importance, hospitals that had initiated systems use on outside processing services increasingly were transitioning to cost-effective in-house systems. As important, the industry increasingly was caught up in the changes wrought by the transition to managed care reimbursement procedures—changes which often included new-systems or systems-upgrades requirements. Furthermore, as a rule, most medical institutions still lack a strong tradition of in-house software development and many seem largely uninterested in strengthening such capabilities.

EXHIBIT IV-5

Medical Industry Factors Favoring Application Software Vendors

- Transition away from processing services
- Rapid change requiring new systems and software
- Lack of strong development capabilities
- Low interest in building in-house strengths

As a result, the last few years have seen steady 13%-14% annual growth rates in the market for medical application software. Once the shape of federal health care reform is clear, this growth is expected to strengthen substantially—in part at the expense of turnkey growth rates. This strengthening will provide software vendors with continuing growth from a solid revenue base, resulting in user expenditures growing at a 15%

CAGR, from $1.2 billion in 1993 to $2.4 billion in 1998. One important marketing tool for medical industry software vendors during this period will be their ability to offer customers rapid applications updates (under maintenance contracts) when significant industry changes occur, such as publication by Medicare of new DRG reimbursement schedules—federal schedules that, under health care reform's managed competition, may drive private reimbursement rates as well.

Such growth will not be uniform among the application software subcategories, however. As has been the case for the last few years, given the increasing power and price-performance ratios of PCs and workstations, growth in mainframe and minicomputer software revenues will be modest, with five-year CAGRs of 5% and 7%, respectively. On the other hand, INPUT forecasts a CAGR of 25% for software that operates on PCs and workstations—and especially calls vendors' attention to the market opportunities for the new generation of portable PC tablet systems that will require great sophistication both in client/server software functionality and in sophisticated graphical user interfaces that minimize or eliminate keyboard use.

4. Systems Operations

Compared to other industries, the medical industry has been one of the more significant users of systems operations. Other major users are banking and finance, insurance, federal government, and state and local government. Steady growth in the medical sector's use of systems operations is expected during the period, as user management presses for further economy in information systems operations.

In the past few years, hospital executives have steadily become more receptive to the use of contract management for resources that support the medical function, but are not necessarily part of it—in the sense that the function of a hospital is to provide medical services, not data processing services. A 1991 study showed that hospitals' use of contract management services is approaching 50% (of the hospital population), and that more than 61% will retain their current vendors when contracts end. To take one sign of the times from the closely related health insurance market sector, in 1992 EDS (Electronic Data Systems) signed a 10-year, $800 million contract to provide all systems operations for Blue Cross and Blue Shield of Massachusetts.

Overall, both private sector cost pressures and federal mandates toward more comprehensive and efficient computer operations will continue to fuel steady growth of systems operations in the medical sector. INPUT forecasts a 13% CAGR for this delivery mode, with revenues growing from $1.2 billion in 1993 to $2.3 billion in 1998.

5. Systems Integration

Closely related to professional services (see the next section) is the market for systems integration. The key distinction between professional services consulting and systems integration is dependent upon who bears the ultimate responsibility for planning and managing a systems installation project. Consulting firms typically provide analytical or technical support as professional services to their clients, seldom bearing responsibility for the result of an implementation project. Systems integrators, in contrast, act as the general contractor on a systems project, assuming project management responsibility and generally bearing some financial risk for the success of the project.

It is increasingly difficult for a medical institution to manage internally their large new-systems projects, given the complexity of today's information services technology, the pressure to adapt to managed care and now managed competition under federal health care reform, and the accelerating pace of technical change in medical information systems technology. This is especially true for those new projects requiring a combination of in-house and outside resources and for the potentially overwhelming challenge of integrating a hospital's department-based "islands of automation." As a result, medical institutions increasingly are transferring such risks and responsibilities to systems integration firms. Although relatively late in joining this trend, the medical industry is continuing to move in this direction—and will accelerate use of systems integrators during this period.

Significant expansion of the medical systems integration market is not projected until the 1994-1995 period, when the federal reform-based managed competition implications of integrating financial and patient-care systems become clear to the medical industry. Until that time, expenditures will be modest, at $300 million in 1993, but a takeoff in growth rates starting in 1995 will lead to a five-year 18% compound annual growth rate (CAGR), driving up revenues to almost $700 million in 1998.

6. Professional Services

Though high-level information systems consulting to the medical industry has a relatively small and steady place today, the delivery mode has never benefited from a broad pattern of sizable contracts to develop large custom systems for in-house implementation. Rather, the industry has tended to rely more on turnkey systems and packaged software and, where necessary, on contracting modifications of such systems and software to the vendor, a third-party consultant, or some combination of the two. Since the 1983 changes in the Medicare reimbursement system, professional services firms serving the medical industry have benefited from institutions' needs to modify in-house systems relatively quickly, both those purchased from outside and those developed in-house.

Only a modest 9% growth rate for professional services is projected during the 1993-1998 time period, mainly as more complex patient-care application packages come to market and require modification to fit particular institutional environments.

7. Network Services

Other than the processing of electronic claims for Medicare—much of the revenue is included in the figures for processing services, as it is an offshoot of the continuing use of generalized processing services—and interconnections within multihospital systems such as Kaiser, there is little other use of network services by the health services sector. Where long-distance networking occurs, it is generally on dial-up or leased lines, and there is little use of remote data base access. While the network services provider CompuServe recently publicized the 10-year anniversary of its Medical Forum on-line service, the five-year trend during this period will favor LAN-based and -shared CD-ROM medical data bases over wide-area network-based information services.

INPUT's forecast shows a strong acceleration of network services growth during the 1993-1998 period based almost entirely on the "coming of age" of EDI-based electronic claims handled outside the processing services delivery mode. First, many firms now using processing services that include Medicare electronic claims capabilities will transfer systems in-house, but will still want to maintain the benefits of electronic claims and reimbursements by signing up for such network services with one or more of the vendors providing them.

Second, institutions increasingly will learn that the timeliness and efficiency benefits they already enjoy (even when transferring claims information by magnetic tape or disk) can be significantly augmented by direct EDI computer-to-computer connections. Also, proposed federal regulations will mandate such direct connections for Medicare claims very early in this period.

Third, private payers during this period will come together in the implementation of EDI-based electronic claims standards, making large-scale transition to EDI for claims more practical and desirable. For dealing with both Medicare and private payers, many institutions will choose to communicate electronically (at least initially) through third-party translation services, which will still be necessary in this period of incomplete standards agreement and implementation.

Based upon this analysis, INPUT forecasts that network services will grow at a 17% five-year CAGR, moving from $660 million in expenditures in 1993 to $1.4 billion in 1998.

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Competitive Environment

A
Introduction

This chapter presents a description of information services vendors serving the medical sector. It is divided into the following sections:

- Market Climate
- Competitive Positioning
- Participating Vendors
- Leading Vendor Profiles

INPUT conducts extensive analyses of vendor revenues. In order to present useful and accurate information for the medical market, non-U.S. revenues were subtracted from worldwide vendor revenues; U.S. revenues only are presented here.

B
Market Climate

The market for medical information systems is in a state of flux, with changes driven by several factors.

First, an industry that has seen information systems in the past primarily as financially oriented accounting and billing tools now is starting to implement new clinical and patient care systems. Two issues are of key importance here: choosing and implementing the new clinical systems themselves and integrating these with established financial systems.

Second, the evolution from the specific cost controls of Medicare reimbursement limits to the more general environment of managed care is changing virtually all the factors of running the business side of a medical institution. This means that older information systems may be obsolete and, in parallel, that substantial new needs exist or are developing for systems to support an institution in the transition to managed care.

Third, institutions find themselves caught in particularly difficult, multistream cross currents of change: systems needs are high for new clinical systems and for new financial systems to compete in the managed care environment, yet margins and budgets are extraordinarily tight. Added to this is the still-swirling current of federal reform, with whatever incentives and disincentives for systems investments emerge from the final package. The confusing impacts of these cross currents are reflected in repeated vendor comments during interviews that buying decisions are still being made at a healthy rate; yet virtually all vendors see surging order rates once the specifics of the final reform package—and thus the implications for information systems and services—are clear.

Fourth, a whole new systems imperative is emerging to flexibly network medical information systems, both within hospitals internally and out to the local medical community, and for both financial and clinical systems. This networking imperative—which is often closely associated with drives toward client/server and open systems networked architectures—adds a whole new order of complexity to buyers' decision making in the medical information systems and services marketplace.

C
Competitive Positioning

As the medical industry market for information systems and services undergoes transition, competition is fierce and operates on two levels. First, any significant competitive opportunity normally brings in several of the industry leaders, each of which can each provide a wide range of systems and services. Second, one or more of the smaller niche players often join the competition as well, pitting their specialized strengths against the breadth and market presence of the leaders.

Although there continues to be a general trend away from processing services—such services remain relatively strong in the medical sector market compared to other industries—this often represents a vendor's success in moving its own client to an in-house solution that it offers in parallel to the outside processing service, rather than reflecting the intrusion into the account of a competitive vendor. The existing vendor often enjoys a "relationship" advantage in such competition.

Similarly, the medical industry shows continued strength in the turnkey delivery mode, despite an emerging shift toward open systems. The medical turnkey vendors, in many cases, simply have evolved their products from proprietary minicomputers to multiple open system workstation or PC environments, keeping customers in part by emphasizing their traditional "total solution" approach, and augmenting this with an open

systems competitive pitch, showing the buyer that competition among equipment vendors can result in savings for the medical institution. The competitive position of turnkey vendors remains strong among medical buyers, who in general tend not to emphasize in-house technical expertise.

The bottom line on competitive positioning in the medical information services industry is that the most successful vendors build and maintain long-term relationships with buying institutions. Such relationships will only be more important in the current and near-future period of rapid changes in medical industry practice, regulations, and use of information systems and services.

D
Participating Vendors

1. Processing Services

Exhibit V-1 lists the leading vendors in processing services for the medical industry. This market segment shows a moderate level of vendor concentration, with one smaller vendor—Health Management Systems—showing revenues that approach those of the market leaders.

EXHIBIT V-1

Medical and Health Care
Leading Processing Services Vendors, 1992

Vendor	U.S. 1992 Market Share (Percent)
SMS (Shared Medical Systems)	19
First Data Corp.	12
CyCare Systems	9
Health Management Systems	6
HBO & Co.	4
TDS Healthcare Systems	1
Micro Healthsystems	1
Leading Vendor Total	52

2. Turnkey Systems

Exhibit V-2 lists the leading vendors in turnkey systems for the medical industry. These figures show the turnkey system market segment to be highly fragmented, with moderate-sized firms like Sunquist Information Systems, Health Data Sciences, and Compucare posting revenues not dramatically below those of the medical market's overall revenue leaders.

EXHIBIT V-2

Medical and Health Care
Leading Turnkey Systems Vendors, 1992

Vendor	U.S. 1992 Market Share (Percent)
SMS (Shared Medical Systems)	8
HBO & Co.	8
Cerner	7
First Data Corp.	6
Sunquist Information Systems	5
Health Data Sciences	4
Compucare	3
Medicus Systems	3
Phamis	2
Clinicom	1
Quality Systems	1
TDS Healthcare Systems	1
CyCare Systems	1
Elcomp Systems	1
Micro Healthsystems	1
Leading Vendor Totals	52

3. Applications Software

Exhibit V-3 lists the leading vendors in applications software for the medical industry. With a moderate level of competitive concentration, this market segment includes midrange rankings for software specialist firms like Dun & Bradstreet Software and Global Software.

EXHIBIT V-3

Medical and Health Care Leading Applications Software Vendors, 1992

Vendor	U.S. 1992 Market Share (Percent)
SMS (Shared Medical Systems)	9
TDS Healthcare Systems	6
HBO & Co.	6
IBAX Healthcare Systems	5
MEDITECH	5
Dun & Bradstreet Software	2
Global Software	1
Source Data Systems	1
Elcomp Systems	1
Micro Healthsystems	1
C.I.S. Technologies	1
Leading Vendor Total	38

4. Systems Operations

Exhibit V-4 lists the leading vendors in systems operations for the medical industry, with a concentrated market segment lead by SMS—Shared Medical Systems.

EXHIBIT V-4

Medical and Health Care Leading Systems Operations Vendors, 1992

Vendor	U.S. 1992 Market Share (Percent)
SMS (Shared Medical Systems)	9
HBO & Co.	2
CyCare Systems	1
C.I.S. Technologies	1
Leading Vendor Total	13

5. Systems Integration and Professional Services

Exhibit V-5 lists the leading vendors in systems integration and professional services for the medical industry. There is a high level of revenue concentration in the market-segment leader, Andersen Consulting.

EXHIBIT V-5

Medical and Health Care Leading Systems Integration and Professional Services Vendors, 1992

Vendor	U.S. 1992 Market Share (Percent)
Andersen Consulting	14
SMS (Shared Medical Systems)	4
CyCare Systems	1
IBAX Healthcare Systems	1
Source Data Systems	1
C.I.S. Technologies	1
Leading Vendor Total	22

6. Overall Industry Market Shares

Exhibit V-6 shows leading vendors for the total information services market.

EXHIBIT V-6

Health Services

Leading Information Services Vendors, U.S. Market

Vendor	U.S. 1992 Market Share (Percent)
Shared Medical Systems	8
HBO & Co.	4
First Data Corp.	2
TDS Healthcare Systems	2
Andersen Consulting	2
Cerner	1
CyCare Systems	1
IBAX Healthcare Systems	1
MEDITECH	1
Sunquist Information Systems	1
Leading Vendor Total	23

E
Leading Vendor Profiles

1. Shared Medical Systems Corporation

51 Valley Stream Parkway
Malvern, PA 19355
(215) 296-6300
Chairman and CEO: R. James Macaleer
Public Corporation, NASDAQ
Total Employees: 4,100
Total Revenue: $469,000,000
U.S. Revenue: $404,000,000
FYE: 12/31/92

a. Company Background

Shared Medical Systems Corporation (SMS) stands apart as the clear leader in health care industry information systems. Founded in 1969, SMS became a publicly held corporation in 1976. The company's products and services are provided to hospitals, clinics, and physician groups for financial, clinical, administrative, and decision support applications under a wide range of delivery modes.

The company is organized into the following divisions:

- Hospital Systems Division
- Laboratory Products Division
- Turnkey Systems Division
- Physicians' Services Division
- Federal Systems Division
- SMS Europe

b. Strategy

SMS aims to achieve record revenues on a continuing basis, increasing earnings at double-digit rates. Growth is strong in both the U.S. and Europe.

The company is positioning itself to lead the health care systems industry in three key technologies:

- Using LAN technologies to integrate both existing departmental systems and newly installed systems

- Applying image processing and optical disc technology, especially in departments such as radiology

- Providing increased accessibility of information through relational data base technology

The company is committed to implementing its systems—including its turnkey systems—on an open systems basis, maximizing the ease of interconnection and of importing and exporting data.

c. Products and Services

Although the company now downplays the "shared" portion of its name, INPUT estimates that approximately 50% of SMS's revenue is derived from remote processing and systems operations services, with most of the remaining half split roughly between software product licenses and turnkey systems. A small amount, about 5%, comes from professional services.

SMS provides processing services to its hospital clients via the Information Systems Center. The Center processes data for more than 800 hospitals and physician groups using IBM 3090 computers, with more than 30,000 client terminals connected.

The company's primary market is acute-care hospitals—generally with 100 or more beds—and physician groups. SMS currently serves more than 1,300 hospitals and physician group practices. SMS software is installed on more than 1,000 client mainframes and minicomputers, with over 100 applications for financial, administrative, and clinical management.

SMS products and services include:

- INVISION® IBM-based clinical, financial, and decision support applications, available either for purchase and in-house use, or as a remote processing service
- ALLEGRA® DEC VAX-based clinical, financial, administrative, and decision support applications for community hospitals with 100 to 400 beds
- The UNITY℠ distributed system, with clinical applications processed in-house on DEC or IBM computers, and financial applications processed remotely at the SMS Information Systems Center
- The DEC VAX-based Laboratory System for either a single hospital or a multientity networked environment
- Professional services of education, custom programming, proprietary network design, system installation, and consulting

- The DEC VAX-based Radiology Management System
- SIGNATURE® physician-group applications for financial, clinical, and administrative functions, available for in-house use on IBM mainframes or as a remote processing service

d. Key Issues

SMS sees continuing strength in the markets for its processing services and systems operations business. Increasingly, the way the firm provides solutions that meet customer needs is by operating on a "health enterprise" model that goes beyond the walls of the hospital. This includes helping SMS customers to evolve to new technologies in ways that help them protect their earlier investments in information systems—in part through open systems implementations that facilitate data exchange.

2. HBO & Company

301 Perimeter Center North
Atlanta, GA 30346
(404) 393-6000
Chairman: Holcombe T. Green
Public Corporation
Employees: 1,650
Total Revenue: $202,221,000
U.S. Revenue: $180,000,000
FYE: 12/31/92

a. Company Background

HBO & Company (HBOC) serves health care organizations of all sizes, providing software products and associated services, system operations services, processing services, and turnkey products.

b. Strategy

HBOC's primary U.S. target market is short-term acute care hospitals of more than 100 beds. The focus is on capturing clinical information and offering network services for ordering, procurement, and claims processing. HBOC also offers products for smaller hospitals, physician offices, and outpatient clinics.

Technically, HBOC is implementing an open systems strategy that has included the migration of its STAR product line to RISC/UNIX platforms that include Data General, Hewlett-Packard, and Digital Equipment. The company's objective is to leverage its product expertise in today's multiplatform configurations and to place an increased focus on the integration of health care information systems. HBOC refers to this strategy as its Information Access Architecture plan.

c. Products and Services

- HBOC's STAR turnkey systems operate on RISC/UNIX systems from Data General, DEC, and Hewlett-Packard. The product line includes systems for patient care, clinical laboratory, radiology, and pharmacy applications, and for financials, including patient accounting, general accounting, and interfaces with general ledger systems. A reportwriter supports ad hoc queries and reports.

- The TREND family of decision support products and services includes processing services, DEC MicroVAX-based turnkey systems, and PC-based products.

- A separate product, QUANTUM, is an executive information system based on the tools and technology of Pilot Executive Software.

- IBM mainframe-based software products provide applications for patient accounting, patient information, and pharmacy.

- QUESTNET network applications offered by HBOC allow its customers to link electronically with HBOC customer support. Future plans include linking customers with insurance companies, credit bureaus, Medicare, and data base services.

- Professional services include software installation and implementation, custom programming, product support, education and training, and long-range systems planning.

- HBOC systems operations services include day-to-day management of information systems for an institution's divisions or departments, management of data center staff, and management of the "rightsizing" process.

d. Key Issues

HBOC is using strategic alliances to extend its reach in three areas.

Working with Imaging Concepts, Inc., HBOC will implement a value-added imaging solution for health care organizations.

Second, in alliance with Clinicom, HBOC aims to build market share in the integration of point-of-care information systems.

The third alliance is with the Healthcare Affiliated Services, Inc. subsidiary of Veritus, Inc., under a joint venture called National Healthcare Partners. This venture offers its Guaranteed Financial Services to accelerate a hospital's cash flow, to reduce accounts receivable days and balances, and to improve business operations.

HBOC places special emphasis on its networking expertise, providing both LAN and wide-area metropolitan networking systems and services. This will be especially important to the firm in implementing its "extended health care community" strategy to link hospitals, physicians, home health care, government, employers, and insurance companies.

3. First Data Corporation

American Express Tower
World Financial Center
New York, NY 10285-4560
212-640-5000
Chairman and CEO: Henry C. Duques
Public Corporation
Total Employees: 19,400
Total Revenue: $1,205,320,000
U.S. Health Systems Revenue: $120,000,000
FYE: 12/31/92

a. Company Background

With 22% ownership by American Express, approximately 90% of First Data Corporation's (FDC's) revenues come from outside the health systems sector, including third-party MasterCard and Visa bankcard transaction processing, oil card and retail card processing, and electronic funds transfer in Australia.

FDC roughly doubled its revenues in health systems through its December 1992 acquisition of Gerber Alley, a provider of turnkey systems to hospitals and physicians. FDC's Health Systems Group is based in Charlotte, NC.

The company provides processing services, turnkey systems, and related services to the medical industry. Its current operations grow out of its formation in 1989 as American Express Information Services Corporation; the First Data Corporation name was adopted in 1992.

b. Strategy

FDC's medical industry business strategy is to generate recurring revenue by developing long-term relationships with clients that use outside processing services and turnkey systems. FDC tries to communicate to health care clients the vision required to build their confidence in FDC's ability to help them adapt to the industry's ongoing changes. This strategy includes a general commitment to support clients in the evolution toward managed care, greater reliance on clinical information systems, and integration of multiple departmental systems. Specifically, this vision

emphasizes the opportunity to have a central data repository that supports development of an integrated patient record—with FDC standing ready as the supporting vendor whenever the client is ready to fulfill that vision at their institution.

c. Products and Services

In the medical industry, FDC provides processing services and turnkey systems to about 800 hospitals in the U.S. and abroad through the Health Systems Group (HSG).

- The Hospital Financial Control system is a distributed processing service that provides modules and reports for accounts payable and receivable, fixed assets, payroll, physician statistics, and third-party billing. Data is transmitted via on-line terminals or PCs from the hospital to large-scale IBM processors at HSG's data center in Charlotte.

- The Tandem-based Patient Care System manages all patient information and recordkeeping, including patient admission and registration, test and procedure ordering, result reporting, historical record keeping, and nursing treatments. It is provided as a turnkey system and is often used as a front end to the HSG financial system.

- SAINT provides small to medium-sized hospitals with integrated in-house financial and patient care software modules for administrative, clinical, and data communications applications. SAINT systems are installed on a turnkey basis at the client's site and maintained by HSG.

- The Precision Alternative® product, acquired with Gerber Alley, is a turnkey-integrated health care information system for medium-sized to large hospitals. Running on DEC and HP computers, the product includes modules for patient care, financial accounting, clinical, and decision support applications.

- ACB Business Services, another business unit of FDC, is a data management system for collection of self-pay fees and for processing of claims to third-party payers, provided on a processing services basis. Services provided by this business unit include on-site receivables management, servicing accounts receivable financing, account collections, letter-writing services, and early-out programs for hospitals.

d. Key Issues

As reflected in FDC's strategic direction, the company emphasizes its ability to meet medical industry clients' needs for fully integrated systems—from baseline accounting systems to new clinical systems to fully computerized patient records. For clients to use these capabilities in order to position themselves for the future, FDC finds that often it is necessary

to leverage technical strengths from other FDC corporate divisions. One example is ongoing work to implement increasingly effective computer interfaces—especially GUIs, or graphical user interfaces—for the newer group of clinical users. ACB Business Services, a unit that specializes in health care receivables management, is another example of FDC's business units working in tandem to achieve corporate health care goals. Finally, FDC finds that clients want a vendor that can help them establish the kinds of larger medical community partnerships—including, for example, systems links among hospitals, labs, physicians, and others—that are required under managed care.

4. IBAX Healthcare Systems

587 E. San Lando Springs Drive
Longwood, FL 32750-5187
(407) 831-8444
President and CEO: Jeffrey S. Goodman
Subsidiary of IBM and Baxter International
Total Employees: 650
Total Revenue: $65,000,000
U.S. Revenue: $65,000,000
FYE: 12/31/92

a. Company Background

IBAX Healthcare Systems designs, develops, and markets information management solutions for small, midrange, and large hospitals, as well as systems for physician practice management. The company was formed originally in 1990 as Spectrum Healthcare Solutions, a partnership of subsidiaries of IBM and Baxter International. The current name was adopted in 1991.

b. Strategy

Building on its parent companies' strengths and market presence in medical information systems, IBAX positions itself as working to help strengthen the medical industry by improving the industry's use of information systems.

With this perspective, IBAX sees the next generation of clinical information systems as an important growth area for the future. Yet the firm also notes that many hospitals are reassessing their investments in such systems in light of the short-term need to develop their financial systems to strengthen the institution's financial health. In the short term, therefore, IBAX is placing increased emphasis on the financial side of its products and services.

c. Products and Services

The company's products and services are used by more than 700 hospitals and 6,500 private physician offices. Approximately 90% of revenues are derived from software products and related services.

- Series 3000 financial and clinical applications for small community hospitals run on IBM RISC System/6000 computers.
- Series 4000 financial applications for midsized hospitals run on IBM AS/400 computers.
- Series 5000 financial and clinical applications for large hospitals and complex medical centers run on IBM mainframe platforms.
- The Physician Series, running on IBM and compatible PCs, communicates patient data to physicians and staff and can communicate with other IBAX systems.
- Point of Care Clinical Series, running on IBM Clinical Workstations™ located at patients' bedsides, supports nursing care documentation and access to the hospital information system.
- IBAX departmental systems support the operating room, radiology department, and pharmacy.
- IBAX services include education and training, implementation assistance, 24-hour customer support, and technical and operations consulting.

d. Key Issues

Key to IBAX's strategy is the effort to educate hospitals about the full impact that clinical and patient information systems can make on effective hospital operations. This is constrained, IBAX understands, by hospitals' limited information systems budgets. IBAX's strategy includes emphasis on the key issue of furthering the financial health of the medical institution.

One increasingly important factor, IBAX believes, will be the implementation of network-based distributed or client/server hospital systems. This includes IBAX products and services to connect hospital and physician office systems.

IBAX relies on customers' perception of its stability as a vendor, based on the partnership of two major information services providers. This perception helps IBAX's potential customers move toward the kind of multiyear commitments that IBAX believes will be required for hospitals to realize fully the power of information systems.

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Conclusions and Recommendations

A
Industry and IS Market Conclusions

As discussed in this report, major impacts on the medical industry's needs for information services are now resulting from pressures on institutions in the new managed care environment. In general, managed care's cost containment and service accountability pressures already serve to heighten needs for new financially oriented systems and services, although funding sources for such investments remain constrained.

In the near future, such impacts will derive from the final shape of federal health care reform, presumably toward some form of managed competition that extends the pressures felt under managed care. Institutions' short-term uncertainties about the shape of reform are delaying many information services purchasing decisions in 1993.

Patient-care systems, networking/system integration, and image processing will be strong drivers of information services use during the five-year period. Short-range uncertainties that still need to be resolved include: demonstrated proof of new concepts like patient-care systems, the role of wireless technologies in the drive to network hospitals, the platforms for and shape of architectures for "open" and client/server systems, and securing capital investment funds.

B
User Issues and Recommendations

1. Key Technology Issues for Users

Key technological issues that medical industry information services users face, summarized from discussions throughout this report, are listed below.

- Identifying the most cost-effective information technology responses to the pressures of managed care and federal reform toward managed competition
- Pioneering new clinical patient-care and medical records systems
- Winning professional-level systems use
- Connecting financial and clinical systems
- Networking and effectively integrating multiple old and various new systems
- Choosing among—and integrating—competing/ complementary bedside, nursing station, doctor's office, and portable technologies
- Adapting systems to changing reimbursement and documentation requirements
- Migrating to "open systems"-based client/server implementations of workstations and PCs
- Expanding from intra- to inter-institution networking
- Implementing electronic transfer of images and medical records
- Applying EDI to electronic purchasing and billing and to other information interchange functions
- Using RDBMSs for care documentation, service cost-versus-reimbursement margin analysis, and other executive information systems
- Securing outside services to plan, provide, implement, and integrate new systems quickly and cost effectively

2. Key Business Issues for Users

Key business issues faced by medical industry information services users are summarized below.

- Quickly and cost effectively adapting to federal health care reform, once enacted
- Evolving cost accounting beyond just charge capture, toward managed care-oriented, service-based cost and reimbursement analysis, both to control costs and to aid in the marketing of medical services
- Building cost consciousness into care planning and implementation
- Adapting to ongoing Medicare reimbursement and documentation changes
- Speeding reimbursements, reducing the number of rejected claims, and cutting claims costs, especially through use of EDI
- Maximizing profitable services
- Centralizing control of independent hospital departments
- Learning to market, compete, merge, and acquire, especially as marketing conditions evolve under managed competition
- Boosting clinical efficiency for professionals
- Winning managed care contracts and physician referrals of patients
- Cutting purchasing costs through EDI
- Cost justifying new information systems investments
- Determining capital trade-offs between medical technologies and information systems
- Analyzing trade-offs between internal implementation of new systems—given pressures for fast action—versus use of outside information services

3. Recommendations for Users

Recommendations for users that derive from the issues outlined in this section are summarized here.

- Plan for federal health care reform by anticipating impacts on the institution's information systems of alternative reform scenarios
- Place a high emphasis on the flexibility of information systems to adapt to changing reimbursement and documentation realities
- Identify and invest in high-value cost-accounting capabilities that support profitability analysis, including RDBMSs
- Educate professionals in cost consciousness and win their support for use of information systems
- Carefully manage privacy concerns arising from new clinical systems
- Balance investments in financial or administrative systems versus patient-care, image processing, medical records, and other high-value information systems
- Determine quickly how well old systems can be integrated and networked, versus needs to replace those systems to achieve connectivity
- Reconsider the use of processing services, mainframes, and minicomputers in light of cost effectiveness trends toward "open system" networked workstations and PCs
- Determine and plan for the role of new client/server architectures
- In general, consider the speed and total-cost values of using outside providers of information services—especially system integration services—in this period of rapid environmental and systems change
- Specifically, evaluate the benefits of a systems operations approach to hospital information systems management. Consider trade-offs between the diluting emphasis on the hospital's core expertise in medical services versus the cost/benefits of having expert contract management of the critical operations/IS function
- Establish central control and networked integration of departmental systems

- Plan future networking architectures carefully and for maximum flexibility, including capabilities within the institution and in the larger medical community. Consider wireless technologies and UNIX
- Commit to maximum use of EDI-based electronic purchasing, billing, and records transfer
- Determine how to cost justify new information systems with nontraditional benefits in light of competing capital investments

C
IS Vendor Issues and Recommendations

Recommendations for information services vendors derive from the same sets of issues that were examined for users, and are summarized below.

- Market-position systems and services toward the latest information about potential federal reform of health care, in terms of benefits that can be provided to the user for a smoother transition. Quickly and solidly reposition around the reality of reform as actually enacted
- In this period of rapid change in medical information information systems, offer and aggressively market broad, potentially in-depth system integration services that will ease the transitions for the buyer—and win new revenue for the vendor
- Emphasize cost accounting and the potential for tight controls, administrative cost savings, integration of reimbursement revenue factors, and ease of reporting for all financial systems
- Integrate financial, administrative, and clinical product lines
- Consider rearchitecting systems away from mainframe and minicomputer platforms and processing services, and toward "open systems"-networked client/server PCs and workstations
- Architect and design/redesign systems so that single entries to a patient's medical records directly update billing accounts and required documentation files
- Partner flexibly with vendors of new patient-care information systems equipment and networking technologies
- Where appropriate, incorporate EDI for purchasing and electronic claims processing in applications software and turnkey systems

- Integrate RDBMSs and executive information systems oriented toward profitability analysis
- Define strategies to win acceptance by skeptical medical professionals. If the physicians are sold, they will sell the institution
- Incorporate image processing and image networking as appropriate
- Broaden networking and integration flexibility, both within the product line and to other vendor's products. Consider wireless technologies (perhaps in partnerships) and UNIX
- Help users build and win acceptance for their IS needs using cost benefit analyses

Forecast Data Base and Reconciliation

This 1993 report shows a turnkey systems market 8% smaller than that projected by INPUT in its 1992 report. This is due to (1) the slowdown in purchases of all capital equipment during 1992 in this sector, due to economic uncertainty and the looming reform of the medical reimbursements system, and (2) the continuing trend away from turnkey systems purchases in favor of applications software products for separately purchased PC/workstation platforms.

The 1997 processing services market is now projected to be 18% smaller than in the 1992 report. This is due to INPUT's findings that movement away from processing services and toward in-house solutions is even stronger than it appeared in 1992.

Systems operations is projected to be 20% smaller in 1997 than it was in the 1992 report. This is due to INPUT's revising the 1992-1997 CAGR downward from 17% to 12%, reflecting more moderate, but still healthy growth in this delivery mode. A surprising number of organizations are now opting to create new systems using a systems information approach and bringing these projects in-house, when outsourcing might have been a serious alternative.

Systems integration, by contrast, is forecast to be 29% larger in 1997 than was forecast in the 1992 report. INPUT expects this accelerated growth, 17% CAGR, to result from pent-up demand for complex systems integration projects, once medical payments reforms are understood, and health organizations commit to the significant systems changes required by those reforms. This explosive growth should begin in 1994-95.

EXHIBIT A-1

Health Services Market
Forecast by Delivery Mode, 1992-1998
($ Millions)

Delivery Modes	1992 ($M)	Growth 92-93 (%)	1993 ($M)	1994 ($M)	1995 ($M)	1996 ($M)	1997 (M)	1998 ($M)	CAGR 93-98 (%)
Sector Total	4,864	10	5,399	5,963	6,754	7,619	8,488	9,449	12
Professional Services	290	8	314	347	381	413	449	490	9
- IS Consulting	70	10	77	86	96	107	118	130	11
- Education & Training	40	10	44	51	55	61	66	72	10
- Software Development	180	7	193	210	230	245	265	288	8
Systems Integration	269	13	305	366	438	516	602	692	18
- Equipment	95	11	105	125	148	170	195	220	16
- Software Products	24	17	28	36	45	56	67	77	22
· Applications Software	15	13	17	21	26	33	40	47	23
· Systems Software	9	22	11	15	19	23	27	30	22
- Professional Services	150	15	172	205	245	290	340	395	18
Systems Operations	1,125	10	1,240	1,400	1,585	1,789	2,020	2,278	13
- Platform Operations	455	8	490	530	575	615	655	700	7
- Applications Operations	420	8	455	502	560	624	695	755	11
- Desktop Services	140	11	155	183	206	240	277	325	16
- Network Management	110	27	140	185	244	310	393	498	29
Processing Services	520	5	545	572	600	624	648	675	4
- Transaction Processing	520	5	545	572	600	624	648	675	4
Network Services	575	15	661	775	902	1,051	1,220	1,420	17
- Electronic Info. Svcs.	340	12	380	420	487	545	610	711	13
- Network Applications	235	20	281	355	415	506	610	720	21
Applications Software Products	1,110	10	1,219	1,390	1,665	1,949	2,193	2,430	15
- Mainframe	385	6	408	432	462	485	504	524	5
- Minicomputer	310	6	330	358	383	409	434	456	7
- Workstation/PC	415	16	481	600	820	1,055	1,255	1,450	25
Turnkey Systems	975	8	1,055	1,113	1,183	1,277	1,356	1,464	7
- Equipment	465	5	490	510	530	555	574	602	4
- Software Products	360	10	395	429	463	513	553	607	9
· Applications Software	310	10	340	371	400	445	480	530	9
· Systems Software	50	10	55	58	63	68	73	77	7
- Professional Services	150	13	170	174	190	209	229	255	8

EXHIBIT A-2

Health Services Market
1993 MAP Data Base Reconciliation
($ Millions)

Delivery Modes	1992 Market				1997 Market				92-97 CAGR per data '92 Rpt (%)	92-97 CAGR per data '93 Rpt (%)
	1992 Report (Fcst) ($M)	1993 Report (Actual) ($M)	Variance from 1992 Report ($M)	Variance from 1992 Report (%)	1992 Report (Fcst) ($M)	1993 Report (Fcst) ($M)	Variance from 1992 Report ($M)	Variance from 1992 Report (%)		
Total Sector	5,014	4,864	-150	-3	9,341	8,488	-853	-9	13	12
Professional Services	295	290	-5	-2	460	449	-11	-2	9	9
Systems Integration	277	269	-8	-3	465	602	137	29	11	17
Systems Operations	1,127	1,125	-2	0	2,523	2,020	-503	-20	17	12
Processing Services	551	520	-31	-6	787	648	-139	-18	7	4
Network Services	579	575	-4	-1	1,351	1,220	-131	-10	18	16
Applications Software	1,125	1,110	-15	-1	2,423	2,193	-230	-9	17	15
Turnkey Systems	1,060	975	-85	-8	1,332	1,356	24	2	5	7

VERTICAL MARKET ANALYSIS

HEALTH SERVICES

1993-1998

U.S. Information Services
Market Analysis Program